FOOD MANUFACTURE

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The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

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FOOD MANUFACTURE

Vol. XIII, No. 1 **January, 1938**

Unsuspected Bacteria

DR. LAMPITT'S discovery of *B. coli* in food dyes is another example of the ubiquity of micro-organisms in the materials composing various raw materials of foodstuffs. In this issue Mr. Barton calls attention to the presence of thermophilic micro-organisms in common ingredients. This is a matter which has only recently had any degree of attention, as is evidenced in the case brought into notice by Dr. Lampitt, by the surprise evinced by his hearers at the meeting he was addressing. We have no doubt but that energetic action will be taken by those concerned. The food industry is conducted by enthusiasts, and in general no pains are spared to maintain it on the highest possible plane of efficiency.

Empire Exhibition

At the Women's Section of next year's Exhibition in Glasgow a new kind of cookery demonstration will be held. First, as a "terrible example", will be shown the "normal" way of cooking foods, and, secondly, how it really should be done. The Countess of Elgin and Kincardine was "At Home" on Friday, December 10, and gave an interesting general description of the Women's Pavilion. Lady Minto described the gardens—already planted—and stressed the efforts being made to make the section colourful and bright.

There will be a consultant clinic where it will be possible to tell a sympathetic attendant all about your ailments and in return receive expert advice about your diet. We anticipate a constant full house for this section and congratulate the ladies on their courage. Ailments are favourite topics, but encouraged . . . !

Charts will be available showing how best "five shillings a week may be spent on food". There will also be a food research laboratory showing work in progress. The occasion would seem to be an opportunity to demonstrate regional cookery in a way similar to that carried out in the Paris Exhibition this year.

Duties on Milk?

Official mills grind very slowly indeed. The recommendations of the Import Duties Advisory Committee in respect to Milk Products made on June 3, 1936, were only presented to Parliament in a White Paper on November 9, 1937. This matter, which is of fundamental importance to our dairy industry, should have had more prompt attention. The Committee stated that imports of condensed milks and milk powders have, in the past, been regulated within certain limits by undertakings voluntarily given by the principal supplying countries. There has been, however, a big increase in milk production with a resulting increased surplus available for manufacture. The capacity for making condensed milks and milk powders in the United Kingdom has also greatly expanded. The Committee reviewed the history of the situation and, having regard to the fact that there are, in this country, ample supplies of milk and sufficient manufacturing capacity to supply the home market, decided that there was no alternative but to suggest that the duty on condensed skimmed milk be increased. In consequence also of serious price competition in whole condensed milk and powder the Committee felt that increased duties on these should also be imposed. Mr. Morrison gave some indication of action in the House on December 7, when he stated that in the legislation to give effect to the White Paper policy the Government would

We wish our readers
A HAPPY NEW YEAR

propose that the standard gallonage of milk for butter and cheese in Great Britain should be 125 million gallons in each case. The legislation will also provide that the price levels at which Exchequer assistance should begin will be 112s. in the summer and 120s. in the winter for butter and 62s. 6d. and 67s. 6d. for cheese. As the present prices are about 133s. and 70s. 6d. respectively the proposals should be of real value. The important point is to get on with the legislation and give some assistance before more dairy farmers are driven out of existence.

Soda Bread

The problems of soda bread flour received a thorough investigation by Dr. D. W. Kent-Jones at a lecture delivered in Cork a few weeks ago. This is a very important matter in Ireland, where the large proportion, if not the majority, of flour is intended for the production of bread of the type known as soda bread. This type of production has its own special problems far different from the usual bread-making flour difficulties and they must be approached in an appropriate manner. Bread which is made by yeast fermentation necessarily has different characteristics from that which is chemically aerated and which has no preliminary fermentation period. In the case of yeast fermentation, changes take place in the structure of the gluten during the fairly long fermentation period prior to baking, and these influence the nature of the dough. This "mellowing" of the gluten or "ripening" of the dough does not occur in the soda bread process. Hence, while for yeast breads flours with very strong glutens are best, for soda breads the weaker flours are necessary. Soda bread was originally made by adding bicarbonate of soda to flour and mixing up with buttermilk. Most of the soda bread is home-made, and hence the amount of bicarbonate used will vary, as will also the acidity of the buttermilk. These variations alone have set up problems for the modern miller, and Dr. Kent-Jones dealt with these in his lecture.

General Requirements

He pointed out that as there is no preliminary mellowing by fermentation, the employment of a soft and rather weak flour such as Australian, Pacific or native Irish wheat is indicated. The protein content should be low and the gluten quality medium to weak, otherwise there may be a "bound" appearance in the loaf. Sometimes, if the gluten is too strong it can be weakened relatively by the addition of cornflour, which has no gluten at all. Even though he has secured the right blend of weak wheat the miller's troubles are not over. They are only beginning. Weak blends of wheat need careful handling in conditioning and milling. For the soda breads the dough must not be too elastic, it should rather be short or "snappy". Too much stability may give the loaf a close and heavy texture. The shortness can be partially brought about by ensuring that there is comparatively little of the binding material present and also seeing that what gluten is there is short and snappy. That this characteristic in the gluten can be brought about by fairly severe heating during conditioning and hot conditioning is now recognised in the preparation of wheats for the soda bread trade. The demand is for a very white loaf, and usually the flours are heavily bleached with powerful bleachers such as nitrogen trichloride, and it is probable that this over-bleaching may have some influence on the gluten quality. The question of variation in the acidity of the buttermilk used is one that must be taken into account. The baker would always blame the flour, and never believe that one day's buttermilk may be only half as acid as another's. What actually happens in practice is that the millers turn out what is virtually a form of self-raising flour in which an acid agent such as acid calcium phosphate is added as well as the soda.

General Conclusions

Dr. Kent-Jones reviewed the types of wheat required for soda bread, and the conditions which must be followed in preparing the wheat and the milling thereof. He outlined the nature and amount of chemical additions and the question of bleaching. He provided a general specification which should result in the flour being satisfactory, and he laid particular emphasis on the danger of excessive alpha amylase activity, and the results of such activity in the flour when made into bread. He further emphasised the importance of proper testing, both from a chemical and a baking point of view, and he indicated certain lines of research which are of great interest to the milling trade.

This lecture, which was published in full in *Milling* on November 27, 1937, states the present position of our knowledge of the factors necessary for the manufacture of soda bread in a clear and concise manner.

Poison Gas and Food

We have referred on several occasions to the procedure to be adopted in the case of air raids and gas attacks. We do not want to be considered pessimists or scaremongers, but we do believe in

the scout's doctrine of "Be Prepared". If our preparations are never needed, so much the better.

The question of preserving foodstuffs during a gas attack is important, and one that food manufacturers and warehousemen ought to study. They will spend a very useful twopence if they purchase the Home Office pamphlet, *The Protection of Foodstuffs Against Poison Gas*. The booklet pays a tribute to the modern method of packaging foodstuffs in standard packets over the old method of delivery to retailers in bulk, in that the modern method affords greater protection against gas. It is pointed out that every layer of material which may help to prevent gas coming into contact with foodstuffs is of value and the issue of unwrapped products should be reduced to a minimum. Preference should be given to the material which affords the best protection against gas. Thus waxed or greaseproof papers are better than ordinary pervious papers. It is urged that as there is often a considerable lapse of time between the packaging of an article and its sale to the consumer, the most suitable packing material should be adopted as soon as practicable. A table is given showing the protective value of different types of packing materials against vapours or liquids. It reveals that while airtight tins and bottles offer complete protection, ordinary papers, sacks, and textiles offer none at all. The variation in gas resistance offered by different types of tarpaulins is also mentioned. The compilers of the booklet appear to be well informed, and it should prove useful.

Food Organisation

Some sort of a pronouncement on what is being done about food organisation in emergency periods was made by Mr. Oliver Stanley last month. He stated that it had been decided, as part of the plans which are in course of preparation for controlling the supply and distribution of food and feeding stuffs in the event of an emergency, to create throughout Great Britain a "shadow" organisation which could, without delay, act as a Food Control Committee in the area of each local authority, as during the period of food control in the Great War. This shadow organisation is to be in readiness in case of emergency to discharge all the duties performed under the Food Controller. This is something, but it is only theoretical. There is nothing tangible about a shadow, and, even so, all this is on paper. It may be very nice to have all the country mapped out into areas and all manner of systems of distribution arranged and tabulated ready for instant action, but what we have always stressed is the concentration on the provision of adequate supplies to be ready for distribution, rather than merely the methods to be applied for distribution. It is a good thing to have the country mapped out into divisions—apart from London and the Home Counties, Great Britain will be divided into fifteen divisions. Of these, eight are in England, five in Scotland, and two in Wales, and Divisional Food Officers have already been appointed. As we have already stated, this is all to the good, and may prove invaluable, but all this elaborate system is useless if there is no food to distribute. The problems of adequate storage are becoming more and more vital, and should be dealt with promptly. Do not let us lose sight of the substance by chasing after shadows.

Jam Standards

We thought that when the Society of Public Analysts and the Food Manufacturers' Federation put their heads together and evolved standards for jam quality, adulteration in this direction would disappear and the public, the producer, and the public analyst would all be pleased and contented. Alas! it is not so, or, at any rate, to judge from the recent analysts' reports, the question is still very vexed. The County Analyst for Lancashire found eight samples deficient out of a total of 63—12½ per cent. defaulters is too big a proportion. Even one-seventh of the samples of marmalade were wrong. The Analyst for Leicester states that "systematic gross adulteration of a downright fraudulent nature, so notorious during the last century, is now probably a thing of the past, unless one excludes the practices of some jam manufacturers". The report of the Leicester Analyst details many of the difficulties that beset the path of the analyst in the matter of jam standards and the many possible ways for unscrupulous manufacturers to "get away with it". The Birmingham Analyst examined 25 samples of jam, and he pointed out that the misdescription of articles of food is a much more common thing than actual adulteration. The City Analyst of Kingston-upon-Hull stated that "the position with regard to jam is somewhat unsatisfactory. There is no legal standard for jam". In his case, seven samples out of fourteen examined were found to be adulterated. It is evident that the high expectations born of the collaboration of the S.P.A. and the F.M.F. have not been realised in the case of jam, and that further action is necessary.

Canned Food in War Emergency

In one of his recent addresses on canned foods, Mr. F. Hirst said that two distinct problems exist

in regard to organising the food canning industry on a war emergency basis. Firstly, the action to be taken before the outbreak of hostilities; secondly, with the co-ordination and control of the industry in wartime. The first is purely an emergency measure, but (Mr. Hirst said) probably the more important of the two. The matter is being studied at the present time from various angles, but we should like soon to see some concrete proposals. The second measure, to can available foodstuffs (especially to prevent waste in cases where the supply of seasonal fresh foods exceeded the demand), could be undertaken by the canning factories as they are constituted at present. However, in the matter of canning solid packs of meat, after the style of corned beef, we doubt whether there are many factories in this country equipped so that they could suddenly handle the large quantities which would be needed. We are well aware that the raw material available would not last very long in the case of a blockade, but Lord Trenchard stated the other day, " If we can hold out for the first ten weeks, we win ", and the distribution of first-class protein in semi-concentrated form would help this.

Human and Bovine Tuberculosis

In view of the current campaign for the compulsory pasteurisation of milk, the recent findings of Dr. Ede Gróh regarding the pathogenicity of tubercle bacilli are of interest. Dr. Gróh, who works at the Institute for Experimental Pathology of the Royal Hungarian Péter Pázmány Scientific University of Budapest, thinks that the human and bovine types of tubercle bacilli need to be associated to develop in the body. The following résumé of his work is extracted from the 1937 Report of the Széchenyi Scientific Society (Budapest).

Since the researches of R. Koch and Schütz it is well known that two kinds of tubercle bacilli are responsible for tuberculosis of mammals: the human and bovine. In the course of years more and more cases of human tuberculosis caused by the animal tubercle bacillus were found. Up to the present, 65 such cases of human tuberculosis of the lungs have been reported from England and nine from Germany, in spite of the current opinion that this disease in man was very rarely caused by bovine bacilli. Dr. Gróh found that the two types do not multiply by means of division, but that they develop from granules (spores). The animal tubercle bacillus develops in three weeks in the form of a small rod, the human in three days. In the bovine bacillus usually five or six spores develop; these by their growth burst the bacillus, are then set free, and from each of them a new bacillus develops in the course of another three weeks, containing again five or six spores. Thus in six weeks we have 36 spores. The bacillus of human tuberculosis produces 16,000 spores in six weeks. Out of the 149 cases examined, both types were present in 148 instances (chiefly in autopsy material); thus the two types together cause human tuberculosis. The symbiosis is caused by the fact that, in the course of its development, the human type requires the metabolism-products of the bovine type, and *vice versa*, and it seems likely that the two types can thrive only when together. The pure human and the pure bovine type never occur in human tuberculosis alone. Different investigators obtained varying results when they infected experimental animals (rabbits) with human tubercle bacilli. The pathogenicity of human cultures depended on the number of bovine bacilli contained therein, and it was in proportion to this that the inoculated animals remained well, were taken ill, or died. Dr. Gróh's researches appear to explain the part played by the bovine tubercle bacillus in human tuberculosis, and to have brought to a uniform basis the many contradictions occurring in the results obtained by the different investigators. It was also shown that, in tuberculosis of horned cattle, the bacilli of human tuberculosis were also found, which hitherto no other investigator had observed.

Purchasing Power and Demand

The numerous investigations, private and official, into nutrition have shown that in practically all industrial countries the consumption of the protective foods is below the minimum required for health. Practically all of them have an agricultural industry which is maintained by a high protective tariff, with the result that they are producing foodstuffs of which the world has now a surplus and from which demand is turning under the influence of dietary change; for example, wheat production in wheat-importing Europe has increased 25 per cent. since the depression.

The evidence available shows that whenever incomes are sufficient, increased quantities of fruit, vegetables, milk and milk products, fish and eggs are demanded, while the demand for meat increases rather less. On the other hand, the demand for bread and flour, fats, sugar and preserves changes hardly at all, and that for margarine and condensed milk falls rapidly as incomes rise. The desires of the consumers are clearly indicated; demand for protective foods will grow with purchasing power or as price levels fall.

1937
RETROSPECTS
1938
ANTICIPATIONS

[1] Elliot B. Dewberry contributes the first instalment of a series of articles which will review past cases of food poisoning, and the investigations arising therefrom which will bring the subject up to the end of 1937. [2] "Exotic fruits on London markets will lead mass buyers to demand new glamorous essences," says Mr. H. Stanley Redgrove, author of "Spices and Condiments," food and flavour and perfume chemist. Mulberry essence now captured, *and* a real innovation for 1938, is no more nasty medicine. [3] Mr. T. H. Fairbrother, Chief Chemist of McDougalls Limited, describes developments during 1937 and indicates the lines of future progress. *Cereal chemists* and everyone connected with the industry will find matter for thought in this authoritative article. [4] First revolution in United States . . . the art and science of MEAT curing . . . nitrite of soda . . . Dr. C. Robert Moulton, meat packing expert, tells . . . shorter curing periods now being used . . . revolutionary smoking procedure . . . more pickle pumped into ham, new freezing methods . . . lithographed colour label on your chop? [5] PLANT and MACHINERY: In this section there is no retrospect. Instead, it is all forward-looking. Here are pictured new machines, marvels of speed, wonders of thought; plant and mechanical contrivances which will help the industrial cook to greater success in 1938. British factories are improving out of all knowledge. A Rip Van Winkle of only five years' sleep would see changes which would make him rub his eyes again. There are already food factories—Britain ahead of anything in the world in lay-out and equipment—there will be more in 1938, and some of them will have this machinery.

Food Poisoning

Elliot B. Dewberry
M.R.I.P.H., M.R.San.I.

Part I.

General Survey

FOOD POISONING outbreaks frequently occur during the summer months, sometimes assuming large proportions, especially when the milk supply is the source of infection. Owing to the fact that the majority of the cases of illness are of a mild and temporary character with rapid recovery and often limited to one or more persons, they are frequently overlooked, and it is only when the attack is of a serious nature, or a large number of persons are affected simultaneously, that the knowledge of the outbreak becomes widely spread and investigations into the circumstances are made. These mild cases, however, should not be regarded as unimportant from a public health point of view, as such illness necessarily lowers a person's resistance and thus renders him or her liable to other infections. Illness resulting from the consumption of infected foods is more common than is generally known.

In a general sense food poisoning is not a notifiable disease, but under the provisions of the Public Health (London) Act, 1936 (Part VIII, Section 82), it was made notifiable in the County of London. This enables the cases to be thoroughly investigated, the source of the contaminated food traced, and further distribution of the suspected article prevented. In addition, the provisions refer to the registration of premises where certain foods are prepared and to the making of by-laws which aim at securing food cleanliness.

Ptomaine Poisoning

For many years the designation "ptomaine poisoning" has been employed indiscriminately to indicate the cause of acute food poisoning outbreaks. Thus ptomaines were named as the chief cause, not only of the harmful effects resulting from the ingestion of tainted meats, but of food poisoning generally, and, in consequence, it has been difficult to eject them from the false position they occupied. These putrefactive alkaloids are not present in the early stages of decomposition and are only formed when putrefaction has advanced to such a degree that the food has become repulsive.

Sir William Willcox, in an address given before the Canned Food section of the London Chamber of Commerce in 1922, said: "The idea that food poisoning is due to ptomaines is quite exploded. I have made a very large number of analyses in fatal cases of poisoning and suspected poisoning; but although I searched most minutely for all signs of alkaloidal poisons, ptomaines, and so on, unless there are some genuine chemical poisons there, my efforts to find these poisons failed. I used not to succeed in finding ptomaines in the viscera which were examined, though many of them were of an extremely advanced nature as regards decomposition which had occurred. So that we can dismiss these ptomaines as the cause of food poisoning".

The Ministry of Health memorandum on food poisoning states: "It is doubted if 'ptomaines' in the sense of alkaloidal substances produced by bacterial action in meat foods have any significance or connection with food poisoning".

Owing to the rapid advances made in the sciences of pathology and bacteriology during the last thirty years, it has been definitely established that the majority of cases of food poisoning (apart from non-bacterial poisons) are due to the invasion of the human subject by certain pathogenic organisms along with the powerful toxins they manufacture, these poisons retaining their potency even after exposure to a temperature already sufficiently high to destroy the organisms. The term "ptomaine poisoning" used in connection with food poisoning outbreaks therefore is misleading and should be discarded in all scientific literature.

When outbreaks of food poisoning are classified a distinct seasonal incidence is observed. The cases appear to be more numerous during the hot months of the year—*i.e.*, July and August (especially in the case of bacterial poisoning)—this being attributed to (1) greater opportunities for infection, (2) increased virulence and pathogenicity of certain specific organisms, (3) larger doses due to rapid multiplication, (4) to supersensibility of the human alimentary tract, (5) to greater liability to fly-borne infection. Moreover, at this particular season of the year, large numbers of persons are on holiday, when, perhaps, they are not so particular as to their diet and are liable to consume articles of food and drink which, ordinarily, they would view more or less with suspicion.

Foods today are prepared in enormous quantities by various processes and methods and are transported hundreds of miles and handled by a large number of persons before reaching the consumer, during which time they are liable to be exposed to the dangers engendered by ignorance or carelessness. During recent years the major portion of our food supplies have been beyond criticism

or suspicion. This may be attributed, not merely to the administration of legislation which probably exacts higher standards for products and their manufacture, but in a great measure to the desire of manufacturers and traders to place on the market clean and wholesome articles of food (purity and quality being of course of first importance in the promotion of sales) and through their various trade organisations, by research and other means, to ensure progress in manufacture, preservation, transportation, and distribution of these supplies. Control of bacteria in our foods is now the aim of a large number of industries which is accomplished by such means as pasteurisation, processing, the use of harmless preservatives, refrigeration, quick freezing, etc.

Owing to the spread of knowledge relating to dietary and nutrition the public is now more discriminating in its choice of foodstuffs, and gives more attention to their purity and quality. The safeguarding and controlling of our food supplies indubitably is an outstanding fundamental problem of public health.

Historical

From time immemorial food has been recognised as a cause of disease, and down through the ages man has gained considerable knowledge—probably from unpleasant or painful experiences—regarding what is fit and what is not fit to eat. It is only in comparatively recent years, however, that investigations have been made and definite information obtained as to the origin and nature of the disease-producing properties sometimes associated with certain foods.

Meat, which has been frequently the cause of outbreaks of illness, was used as an article of diet from the earliest times, as researches of geologists seem to prove that prehistoric man lived partly on the flesh of animals. Moreover, the higher hieroglyphics of the Egyptians revealed the fact that meat and meat foods must have entered

The late Professor E. J. McWeeney, of Dublin, who investigated an outbreak of illness caused by eating the meat of a diseased animal, which occurred in a Limerick industrial school in 1909.

A bacteriological laboratory.
(Courtesy of United Dairies, Ltd.)

largely into the dietary of the ancient nations, and regulations regarding their use were enforced by officials. It was also recognised that animals which had died a natural death, or were killed "to save their lives", were unfit for human food.

Food poisoning was mentioned in the ancient writings of Hippocrates, Horace, Ovid, and other philosophers, but doubtless was of a somewhat different nature, and probably resulted from the accidental consumption of poisonous fungi, herbs or plants. Records tell us that the Greek poet Euripides lost his wife, daughter, and two sons, who during his absence had eaten poisonous fungi in mistake for the edible variety. Theophrastus (300 B.C.), in his history of plants, makes several references to poisons and records that these were sometimes added to food with criminal intent, or for monetary greed. Zenophen (400 B.C.) remarks that the addition of poison to food and drink was so common amongst the Medes that it was customary for the cup-bearers to taste the wine before it was offered to the King.

During the Roman period, oysters were used by Empresses, who were not the most devoted or virtuous of wives, as easy and agreeable agents in which to administer poison to their husbands or lovers. Wynter Blythe (*Foods, their Composition and Analysis*) mentions a number of interesting incidents in which food was adulterated in Roman, Grecian, and early English times.

In the Middle Ages intentional poisoning was so common that official food tasters were appointed, and there is no doubt that during this period adulteration of food was practised with impunity. Sick animals were slaughtered and the diseased meat disguised and sold as sound food; the result of such practices can be well imagined.

Early Conceptions

History relates that the early conception of food poisoning was ascribed to chemical poisons and in no way was associated with any bacterial theories. In 1856, Panum demonstrated that the poisonous qualities exhibited by putrid fish were of a chemical nature and undestroyed by boiling. Later extensive studies were made upon the poisons present in decomposed food, especially meat, and their effects upon animals. A number of these putre-

factive alkaloids, designated "ptomaines" by Selmi, were isolated by Nencki in 1876. In 1882-1889 Brieger and other observers investigated these substances and found they possessed highly poisonous properties, especially when injected into animals. This "ptomaine" hypothesis —the chief characteristic of which was the onset of symptoms after a short latent period—was widely accepted for many years, and it was naturally surmised that the real cause of food poisoning had been discovered.

The work of Vaillard (1902), Fornario (1906), Cathcart (1906), Savage (1921), and other observers has since proved that these substances were non-toxic to experimental animals except when administered in excessively large doses, far larger than ever likely to be ingested under natural conditions. Also that ptomaines were not present in food until it had reached an advanced stage of decomposition, when it would be repugnant to the normal senses.

Bollinger (1876-1880) collected the literature on the subject and drew attention to the relationship between meat-poisoning outbreaks and the septic, pyæmic, and gastro-intestinal conditions in the animals from which the meat was derived, and the heat-resisting properties of the poisons associated with such diseases which were undestroyed by cooking.

Apparently the first bacteriological investigation into the etiology of meat poisoning was made by Johne in connection with an outbreak which occurred at Lanterbach. He isolated a bacillus which proved pathogenic to other animals.

Klein, in 1880, carried out some bacteriological examinations in connection with an outbreak of food poisoning (infected ham) at Welbeck (Notts), but without definite proof that the bacteria caused the illness. Five years later Salmon and Theobald discovered an organism from cases of swine fever, which was afterwards named by Kruse *B. suipestifer*, but the bacillus was apparently not connected with any disease in man.

Gaertner of Jena in 1888, when investigating an outbreak of meat poisoning at Frankenhausen, isolated an organism (*B. enteritidis*) from the fatal case and from the organs of an emergency-slaughtered cow from which the meat was obtained. There were 58 cases with one death. This particular investigation proved to be a most important landmark in the history of bacterial food poisoning, and since that date *B. enteritidis* Gaertner, and closely allied forms, have been the cause of outbreaks of food poisoning on very many occasions.

One of the most typical outbreaks of illness caused by meat derived from a diseased animal occurred at an industrial school in Limerick in 1909 and was investigated by McWeeney of Dublin. There were 73 cases with 9 deaths, and a strain of Gaertner's bacillus was isolated from the fatal cases.

Ballard, in 1890, compiled for the Local Government Board an important summary on the then known etiological facts in relation to food poisoning.

Outbreaks of food poisoning have been prevalent in Germany for many years, especially the numerous cases of "sausage poisoning" in Würtemburg and parts of South Germany. Van Ermengem studied many of these —some due to *B. enteritidis* and allied organisms—and

Mr. G. Savage, B.Sc., M.D.(Lond.), D.P.H., ". . . we owe an important advance to the investigations of Durham in 1898".

discovered in 1896 the anaerobe-bacillus *botulinus*. He demonstrated that it produced a virulent toxin, which proved to be the true cause of the fatal illness known as botulism.

Durham and de Nobele (Belgium), working independently in 1898, described a bacillus which was found to be closely related to *B. enteritidis*, to which they gave the name *B. aertrycke*. The discovery of this organism proved to be of paramount importance, as it has since been shown to be responsible for a very large number of cases of food infection. Savage remarks: "We owe an important further advance to the bacteriological study of food infections to Durham, who demonstrated in 1898 that by the use of the agglutination tests the bacilli isolated from food poisoning outbreaks, hitherto all indistinguishable, could be separated into at least two distinct groups. He also drew attention to the diagnostic value of the examination of the sera of patients suffering from food poisoning." *B. aertrycke* is now often designated *B. typhi-murium*, this being the name given to an organism isolated by Loeffler in 1892 from a mouse epizootic and subsequently found to be identical with *B. aertrycke*.

In 1900 Schottmuller showed that two distinct types of paratyphoid bacilli existed and these were afterwards designated *B. paratyphosus* "*A*" and "*B*" respectively.

During the period 1909-1915 the Salmonella group of organisms (a sub-group of the typho-coli group and designated "Salmonella" in honour of Dr. Salmon, who

The late Dr. Edwin Oakes Jordan, of Chicago University, a worker distinguished by his part in the important classifactory work on serological lines investigated in 1918.

discovered the hog cholera bacillus) received a good deal of attention by various observers, both as regards their relationship to one another and their significance in certain illnesses caused by infected food. About this time considerable confusion existed in Europe and America as to what organisms comprised this group. Much valuable research on the differentiation and classification of the various strains was carried out by Savage, Bainbridge, Boycott, O'Brian, and others. In America, a vast amount of important classificatory work on serological lines was also done by Jordan, Meyer, Krumweide, Kohn, Hutchine, Valentine (1918), and Schutz (1915-1920).

In 1912 McWeeney published his articles on the etiology of meat poisoning and in the same year Bainbridge, in the Milroy lectures, gave a detailed review of the whole subject and drew attention to the importance of the rat in relation to meat poisoning, and the possibility of the contamination of food by these rodents. Savage, in 1913, in a report to the Local Government Board (Food Reports No. 18), gave a summary of the existing knowledge of bacterial food poisoning, and in 1920 the Cambridge University Press published his valuable work *Food Poisoning and Food Infections*, in which he included a list of British food poisoning outbreaks from 1878 to 1918.

During the Great War (1914-1918), although enormous quantities of preserved foods were consumed by the troops, only one outbreak of food poisoning was recorded. This occurred in 1918 at a base in France, and was investigated by Perry and Tidy (*Spec. Reports, No. 24, Med. Res. Comm.*, 1919), over 1,000 men being affected. The epidemic was caused by *B. aertrycke* and was ascribed to a human carrier.

The Ministry of Health, in 1921, issued a memorandum (*Memo. 39, Foods*) on the procedures to be taken for the investigation of outbreaks of illness suspected to be due to food poisoning and a further memorandum to Medical Officers of Health (outside London) (*Memo. 188/Med.*) was issued in 1935.

In August, 1922, a serious outbreak of botulism occurred in Ross-shire, Scotland (the Loch Maree tragedy), where 8 persons died as a result of eating sandwiches containing wild duck paste infected by *B. botulinus*. These were the first known cases of botulism to have occurred in the British Isles, and the outbreak formed the subject of a special report (in 1923) by Gerald Leighton to the Scottish Board of Health. As a result of this lamentable tragedy the Ministry of Health made arrangements for a supply of botulinus anti-toxic serum to be available at several centres in England and Wales and issued instructions for its use. In 1923 Leighton published his work on botulism and food preservation, in which he gave a comprehensive study of the Loch Maree tragedy. This publication marked an epoch in the medical literature in this country as it was the first British work on the subject.

In America, where cases of botulism have been fairly common, the whole subject has been carefully and systematically studied by Dickson, Meyer, Geiger, and Bengtson, and valuable and informative literature has been published from time to time as a result of research by these observers.

Among the principal works published in the U.S.A. on food infections and intoxications are those by Jordan (1917-1930), Damon (1928), and Tanner (1933).

In England, during 1925, two special reports by Savage and Bruce White were issued by the Medical Research Council on the following subjects: *Investigations of the Salmonella Group with Special Reference to Food Poisoning; Study of 100 Outbreaks of Food Poisoning* (Special Report Series, Nos. 91 and 92).

These were followed in 1926 by *Further Studies of the Salmonella Group*, by Bruce White. The publication of these very important and comprehensive studies was another landmark in the history of food poisoning and added considerably to the knowledge on the subject. The reports dealt with the identification and classification of the organisms of the Salmonella group and the physiological effects produced in animals by the results of Salmonella infections, and also described the results of detailed investigation, epidemiological and bacteriological, of 100 actual outbreaks of food poisoning in this country.

American Outbreaks

In America during the past few years several outbreaks of illness have been caused by the consumption of certain

(*Continued on page 15.*)

H. Stanley Redgrove, B.Sc., F.I.C. on FLAVOURING ESSENCE PROGRESS IN 1937

DEALING WITH progress in flavouring essences in an article on the subject published in this journal of June, 1937, attention was directed to the fact that, although flavouring essences and perfumes have much in common, whereas novelty in perfumes is much sought after, novelty in flavours is not appreciated, at any rate by the bulk of the British public. Hence, development in flavouring essences is far more restricted than development in perfumery, the chief problem being the improvement of flavouring essences corresponding to popular fruits.

On the other hand, it was also pointed out that, as a result of improvements in transport, the general public were now becoming better acquainted with a number of fruits which at one time were either unobtainable in this country in a fit state to eat, or were expensive novelties known only to epicures. A recent stroll through the Soho district of London gave a vivid demonstration of the truth of this. Here, displayed on barrows for sale at prices ranging from 2d. to 6d. were numerous fruits such as persimmons, avocado pears, custard apples and mangoes, which, but a few years ago, were obtainable only from high-class fruiterers who were not patronised by the masses.

A growing acquaintance with the delicious flavours of these and other hitherto little-known fruits must inevitably result in a market for fondants, pastilles, table-jellies, blanc-manges, soft drinks and so on, having similar flavours—a market which progressive flavouring essence manufacturers should by no means neglect.

Passion Fruit

Something has already been done in this direction. Among the fruits which may be termed "new" from the point of view of the British public as a whole, the passion fruit has secured a wide measure of popularity. One firm, in particular, has recently concentrated attention on this very attractive fruit. The firm claims to have isolated the material responsible for the special flavour of passion fruit, which, it is stated, is incorporated in the firm's series of passion-fruit flavours, of which there is a good range suitable for various purposes.

I am told that, in New Zealand, a favourite fruit salad is made by squeezing passion-fruit juice over fresh pawpaws. I have never tasted this combination, but it sounds very good. A reproduction of the combined flavour might be a task worth essaying by flavouring-essence manufacturers.

Old-Fashioned Fruits

Another line of development has as its objective a revival of interest in the flavours of fruits which, once much cultivated in this country, have fallen out of fashion. In the article to which reference has already

Passion fruit and tung oil plantation, North Auckland, New Zealand.
(Courtesy, High Commissioner for New Zealand.)

been made, attention was called to the fact that a progressive British firm had placed a mulberry essence on the market. The cultivation of mulberries has declined almost completely in this country, not because the fruit is unpalatable—indeed, it is delicious—but because it is difficult to market, owing to the rapidity with which it goes rotten. Another once very popular fruit which has fallen into neglect, seemingly for less cogent reasons, is the quince. It is interesting to note that within recent months a well-known firm has placed on the market an excellent quince flavouring essence, suitable for use in ice-cream, and other types of confectionery. This essence is noteworthy on account of its freshness and the gratifying fullness of flavour it develops in the mouth.

Orange Oil

At one time, Sicilian hand-pressed orange oil had no serious competitors either for use in flavouring essences or in perfumes. In both industries, that of flavouring essences and that of perfumery, the orange aroma is one of leading importance. The Italian monopoly has, however, been completely broken by competition from Africa and California. So far as the orange note in flavours is concerned, readers who were present at the Chocolate and Confectionery Exhibition held in London last September may recollect that one leading British firm had a display of jellies flavoured by means of Californian orange oil. The writer tasted them, and considered the flavour to be excellent.

In parenthesis, it may be mentioned that a novel feature of this exhibition was a kinematograph display by the same firm showing all stages in the cultivation of peppermint in America and the distillation of peppermint oil. Displays of this sort stimulate interest and are educative. It is to be hoped that there will be more of them.

Improvements in Standard Flavours

Several notable improvements in what may be termed "standard" essences have been made during the past year. It has been the writer's privilege and pleasure to examine an improved pear essence in which the unpleasant twang of amyl acetate was entirely absent—an essence notable for richness and delicacy of flavour and into whose composition new synthetics undoubtedly enter; a new pineapple essence, exactly reproducing the flavour of tinned pineapples—a flavour preferred by many folk in this country to that of the fresh fruit, hardly ever tasted here to perfection; and improved loganberry and cherry essences, as well as others.

Flavouring Medicines

A subsidiary problem of interest to the industry is that of disguising the taste of nauseous drugs in medicines. The days have gone when the efficacy of a medicine was thought to be in direct proportion to its nastiness; and, to-day, there is a growing demand for medicines which are pleasant to take. The problem of disguising the taste of a nauseous drug is not always an easy one. There are two methods of approach. The taste or flavour of the drug, although repellent in itself, may be blended in with other flavours so as to produce a palatable combination. For example, bitterness is commonly regarded as unpleasant, yet a bitter taste may be blended with certain flavours to produce a decidedly pleasant combination. Bitter beer and gin and bitters are examples. Alternatively, when this is not possible, a strong flavour may be added to overpower the nauseous taste of the drug. This is less satisfactory, as the medicine, in this case, usually leaves an unpleasant after-taste.

Mr. Harold N. Wright, with the aid of over one hundred students, has recently conducted a research into this question in America. His results have been published in the *Journal of the American Medical Association*, and were summarised in the issue of the *Manufacturing Chemist* for August, 1937. The research had as its object the determination of the flavouring agent used in medicine having the biggest appeal, and those flavours best able to disguise the tastes of (*a*) bitter-tasting drugs, (*b*) saline drugs such as ammonium chloride, and (*c*) tincture of digitalis. Syrup of cacao N.F.V. headed the list as the flavour with the most general appeal, closely followed by syrup of raspberry, N.F.VI. Syrup of cacao also headed the list of flavours best able to disguise bitter and saline tastes, though syrup of cinnamon found most favour in the experiments with tincture of digitalis.

Passion fruit harvesters in New Zealand.
(*Courtesy, High Commissioner for New Zealand.*)

Pressing passion fruit in a New Zealand factory.
(*Courtesy, High Commissioner for New Zealand.*)

CEREAL CHEMISTRY

IN 1937

By T. H. FAIRBROTHER, M.Sc., F.I.C.

IN HIS review of Cereal Chemistry for 1936 in FOOD MANUFACTURE the writer referred to the increasing use of standard mechanical methods such as those recommended by Brabender, Chopin, Fornet and others. There seems to be very little change in the position to-day. A number of laboratories have carried out further investigations on these various mechanical methods and published interesting papers. But to the writer's mind a slight reaction seems to have set in and certain workers are not now quite so enthusiastic about mechanical methods as they were. Some have actually gone back entirely to the experimental baking test.

The mechanical phase came along so rapidly and such a spate of papers followed the introduction of the farinograph, the fermentograph and the extensimeter that one was hardly able to keep pace with the ever-increasing mass of data, and a sharp attack of mental indigestion and an accompanying revulsion against the new methods was inevitable. It seems likely now, that after the "first fine careless rapture" which attended the advent of these various machines has passed and the plausible stories that various workers wove round the diagrams obtained have been more or less translated into commonsense, these ingenious machines will settle down into their correct place and will be used to obtain valuable information on many problems.

The writer has never believed—nor does he think he ever will—that the whole story of flour and bread will ever be reducible to a simple diagram. There are many factors other than mechanical considerations to be taken into account. Even the mechanical diagrams themselves may be misinterpreted. The strength of a flour, for instance, is shown on a diagram as a record of its resistance to mechanical handling. It must be remembered, however, that when a dough is weakening to the point of stickiness this very stickiness may offer up a resistance to the kneading blades which may be misinterpreted as strength. Be this as it may, there can be no doubt that the mechanical methods are extremely useful and, when viewed in their proper perspective, may provide many illuminating pictures.

Recent Applications

Obviously one's first inclination on looking back in review of last year's progress is to see in what direction these recent mechanical considerations have been applied and how they are affecting general trends. One of the most interesting developments has been the use of the extensimeter in commercial tests to serve as a basis for the sale of grain. It is reported that extensimeter tests, with this end in view, are being carried out on a large scale in Tunis. It is probably in the official interpretation by mechanical means of the baking value of wheats that the future of these machines lies.

Such instruments as the farinograph are at present possibly more appreciated by bakers than millers, as they give to the former a concrete picture of what the latter is supplying. Whether this picture is of the plain landscape type, full of innocent truthfulness, or of the surrealist type, full of innuendoes, is another matter. It is a picture, and this is more than bakers have had up to now. If a movement is coming (and it looks as if it is) for bakers to buy their flour on the basis of the characteristics of the farinogram and fermentogram, then it surely behoves millers to look closely into the matter to find out what factors there are which may in any way influence the picture. As an example of this the work of Rupp and Bailey (*Cereal Chemistry*, July, 1937, p. 496) on the effect of protease increments on the plasticity of doughs may be quoted. These workers had to admit that it was difficult to make quantitative determinations of the effects of wheat proteases or their activation by cysteine hydrochloride and glutathione. Chemical methods are not suited for such measurements because pronounced effects, as indicated by changes in the physical properties of the dough, may be accompanied by only slight variations in the measurable chemical constants.

Physical measurements are attractive since they may afford an indirect basis for measuring proteolytic action. In work of this nature the farinograph has proved of great value. The miller is able to see clearly, for example, the effect of sprouted wheat, which contains more active proteases than normal wheat, and he may thereby obtain valuable information. This is only one of the many uses to which the farinograph may be put.

General Physical Methods

It is not proposed again to give details of the different machines that have been invented for the mechanical interpretation of flour strength. These were dealt with in last year's review and there are apparently no fresh ones. It is only proposed this year to refer to a few researches carried out in the further development of the field.

An interesting offspring of the extensimeter is a recording kneader called the alveograph, described by Chopin. It is a refinement and simplification of the extensimeter. The thickness of the dough film is regulated automatically, thus eliminating personal error, and the temperature is controlled, which is a further important consideration. Brabander (*Mühlenlab.*, 1937, p. 121) has applied the

amylograph, an instrument for measuring viscosity at any given temperature or at rising temperatures, to a study of the physical properties of wheat and rye. His theory is that in wheat flour the starch is practically an inert filler at temperatures below 60° C., and dough structure depends on the albumins, particularly glutenin (difficult to swell) and gliadin (easy to swell), which form fibres. These fibres are interlaced by kneading and separate on standing. They also undergo permanent changes owing to proteolysis or fatigue. These changes are modified by heat treatment, hydrogen-ion changes or improvers, and, according to Brabender, are best studied by means of viscosity measurements.

The fornetograph, to which reference was made in last year's review, has been further developed by its sponsors, Fornet and Ihlow. These workers state that it can be used for testing the quality of wheat as well as of flour. In a paper (*Mühlenlab.*, 1937, vol. 7, pp. 33 and 49) the effect on the curves of added flour, yeast and dextrose is recorded. In another paper (*Z. ges Getreidew.*, 1937, p. 123) they state that fine meal is best for use in the fornetograph, and uniformity is very important. The grain, dried at low temperature, is first milled coarsely and bolted through a 000 gauze. The overtails are re-milled rather more finely and the process continued till all goes through.

Other workers have devoted much time to the study of physical methods. Swanson has further developed the Swanson Working Recording Dough Mixer. This differs from Brabender's farinograph in stretching more and kneading less, a much more severe treatment. It is claimed that the machine is directly useful to the practical baker by giving the correct mixing time and fermentation tolerance of a dough.

Nottin, Daron, Geoffroy and other workers have investigated the Pelshenke method, but this does not yet seem to be very reliable, and apparently many discrepant results are obtained. With these brief remarks we will leave the physical methods for another year's study. Doubtless papers extolling the virtues of this, and the fallacies of that, machine will appear with clockwork regularity. In the meantime most cereal chemists will read all they can and do such individual research on these machines as their time and available equipment will allow; but they will still continue washing out glutens, determining proteins and doing test bakes.

Analytical Methods

Some progress has been recorded in the modification of routine laboratory tests. The ash test, doubtless because up to the present it is the most reliable index of grade, has received much attention. A most interesting paper which reviewed the literature regarding methods of ashing cereal products was given by Bailey at the annual meeting of the Food Research Division Bureau of Chemistry and Soils at Washington. After a critical review of all methods Bailey recommended a modification of the magnesium acetate method. When 3 gm. of flour is moistened with 3 c.c. of an alcoholic solution of magnesium acetate and incinerated at 700° C., a white fluffy ash is obtained in three-quarters of an hour.

Stewart and Arthur compared the results of ashing at 650° C. in a muffle and at 450° C. with oxygen in a combustion furnace. They found agreement better in the latter. After investigating volatilisation losses in various conditions an improved method of carrying out the determination was described. The writer has carried out numerous investigations on the different ash tests that have been suggested and still believes that the most reliable and rapid results are obtainable with the alcohol glycerol method.

Nitrogen Determination

Every year brings forth a fresh crop of papers on the estimation of nitrogen in wheat and its products, and this year has been no exception. Bartosiewicz claims to have reduced the time for one determination from twenty to seven minutes by using a pump when washing out the distillation apparatus and introducing a two-way cock between the steam generator and the rest of the apparatus. Scott and West, in the Analytical Edition of *Ind. Eng. Chem.*, 1937, vol. 9, p. 50, have also described a simplified apparatus. Certain modifications in technique have been recommended.

Iyer and his colleagues (*Chem. Abs.*, 1937, vol. 31, 6132) have reported that in the chromic acid-sulphuric acid digestion, losses of nitrogen due to formation and decomposition of ammonium bichromate are avoided by adding the chromic acid to a boiling mixture of the material with sulphuric acid. The question of the catalyst is one that has received the greatest attention from numerous workers and which seems still as vexed as ever.

Gluchovzeva and Chertok claim that digestion time is shortened by a catalyst containing potassium and copper sulphates and mercuric oxide. Digestion with potassium sulphate and titration with formalin is stated to be as accurate as the Kjeldahl method. Murneek and Heinze, however, in a comparative study on soils and plant materials of the various catalysts, concluded that selenium greatly reduced the time of digestion. Other catalysts recommended are hydrogen peroxide with copper sulphate and hydrogen peroxide with mercuric sulphate.

Cassidy (*Ind. Eng. Chem.*, An. Ed., 1937, vol. 9, p. 478) has described a rather ingenious way of eliminating the use of a fume cupboard. A test tube, perforated near the bottom and containing soda lime or a suitable absorbent on a layer of glass wool or beads, is tightly fastened into the neck of the Kjeldahl flask by a collar of filter paper. In this way all acid fumes are absorbed—a useful tip for a small laboratory.

Moisture

The determination of moisture in wheat and flour is one of the most important single tests in the cereal laboratory, and much work has been devoted to the rapid and accurate determination. Research to-day seems to be mainly devoted to a continuous record of moisture in the wheat stream. This, of course, is very desirable in wheat conditioning. If a device for recording continuously the moisture content of the wheat emerging from the conditioner was elaborated, adjustments could be made rapidly and many economies effected. Brabender

seems to have got the nearest to this ideal in his F.K. plant. He makes use of the "damping" method, which determines the moisture content in grain by measuring its damping effect upon high frequency waves. The apparatus measures and registers the moisture content in a continuous grain stream tapped from the wheat flow leaving the conditioner. The first of these F.K. plants was made some years ago, but many technical difficulties had to be overcome and now the machine is stated to be fool-proof. The writer has had no personal experience with the plant, but he has discussed it fully with an English miller who has one in use and declares it to be a most valuable instrument in the control of the regularity of conditioning.

Rutter has patented a process of moisture determination based on a continuous cooling effect. The moisture is determined continuously by the fall in the temperature of air at known temperature and moisture content passing through the stream of grain at right angles. While big practical difficulties are to be overcome there seem to be possibilities in this method. Recent developments in the laboratory determination of moisture include a very elaborate oven supplied at a high cost by Brabender. The material is weighed while in the oven, the dish containing it being raised on a tripod connected with a balance below. The writer experimented with one of these machines and obtained excellent results. Its high price, however, renders it prohibitive to most laboratories. If, on the other hand, the machine gave an instantaneous reading of moisture it would be worth the cost, but as it is, it has no marked advantages over the normal ovens which are infinitely cheaper. Chemical methods are still used, and several papers on the determination of moisture by interaction with calcium carbide have appeared during the year.

An interesting desiccator has been described by Kranz. The lower chamber is wide mouthed, to expose the maximum drying surface. Pressure is relieved through a side tube which extends to the bottom of the desiccator so that any incoming air passes through the whole drying layer. The vertical portion of this tube is provided with a thermometer.

Proteolysis

Anyone reviewing the cereal literature of the last twelve months must be struck by the increasing attention paid to the question of proteolytic activity. Of course this interest has not been born in the last year, it has been recognised for many years that the enzymes of flour are a most important factor in the evaluation of its bread-making qualities. It is now generally recognised that proteases which occur naturally in the flour or which are introduced with the other ingredients used in bread making have a profound influence on the properties of the dough and the resulting loaf. Malt extract contains proteases and if this is added to improve the diastatic action the influence of the proteases must not be overlooked. Sprouted wheat contains proteases, and if there is any in the grist, preparation must be made for the action of these enzymes. It has generally been considered that protease action has a deleterious effect on gluten, but more recent work indicates that the addition of small amounts of protease especially in "bucky" doughs produces a mellowing effect and renders the dough pliable and lively, giving better loaves. Balls and Hale (*Cereal Chem.*, vol. 13, p. 54) suggested that the first action of a protease is one of coagulation which renders the gluten more tenacious, but later the coagulated protein is degraded by progressive hydrolysis. It thus appears that small additions of protease might prove beneficial rather than deleterious.

There have been many researches on the nature of wheat proteases and the latest work indicates that they are of the papain type. It has been shown that they can be activated by cysteine hydrochloride and glutathione, and Jorgensen has demonstrated that they can be inactivated by ascorbic acid. Of the many papers published, only a few can be referred to here. Balls and Hale (*J. Ass. Off. Agr. Chem.*, vol. 19, pp. 372, 1065) determine the proteolytic activity in flour by the change in the rate of fall of a lead shot through a flour-water paste saturated with carbon dioxide. In this paper they state that the protease is inactivated by bleaching with an oxidising agent. Schmidt adopts a simpler method. He allows the dough to stand for one hour and then extracts gluten in the usual manner. Read and Haas (*Cereal Chem.*, 1937, vol. 14, p. 58) found that purification of amylase by fractional precipitation intensified the proteolytic power to the same extent as the amylolytic. Baking tests with the purified amylase showed improvements which Read and Haas attributed to the proteolytic activity. Blagoveschenski and Yurgenson (*Cereal Chem.*, 1937, vol. 14, p. 103) state that the first stage in proteolysis is a disaggregation without production of free amino and carboxyl groups. Geoffroy (*Bull. Ecole. Fr. Meun.*, 1937) carried out an investigation on proteolysis using physical methods (viscosity, extensibility and stability) and found that it was favoured by yeast and checked by oxidising agents. A patent (B.P. 464,857, 22/7/35) has been taken out by Dansk Gaerings-Industri covering the use of an oxidising agent containing a halogen oxy acid or a per acid for checking proteolysis without interfering with other enzymes. There have been many other interesting researches in this particularly fruitful field, but space does not permit any further mention.

Flavour

Considerable attention has been devoted to the question of flavour and freshness of bread. In view of the decreasing consumption of bread this is important. Either the public taste has altered or modern methods of baking and handling have changed the flavour of bread. Public opinion, freely expressed, proves this. The writer is fortunate in being able generally to eat home-made bread with a good percentage of yeast in it, but when travel or other circumstances compel him to eat commercial bread he feels like acting on the message to the church of Laodicea. What is the cause of this? A number of people have tried to answer. Katz, in conjunction with the Research Association of British Flour Millers, has published a lengthy dissertation on the subject. Gray (*N.W. Miller*, 1937) states that the results of a questionnaire to

American bakers indicate that palatability is improved by low fermentation temperature, long baking time and higher extraction rather than short patent flour and freshness. Cathcart (*Cereal Chemistry*, 1937, vol. 14, p. 735) describes a system of judging flavour in which each judge is given two samples at a time of the crumb only. Reproducible results were obtained, which were substantially the same for selected and unselected judges. In this way various factors (fermentation, baking, freshness, etc.) which had an effect on flavour were determined. There can be no doubt that if the "Eat more bread" campaign is to have positive results the question of bread flavour must be investigated. The public wants palatability, not posters.

Improvers

Closely linked with the flavour problem may be the use of improvers. It is surprising to note how many and how varied are the substances used for this purpose. The Dansk Gaerings-Industri have patented ascorbic acid (vitamin C) or an alkali ascorbate for improving baking quality. The patent states "in quantities insufficient to affect the flavour". Who can say what is this limit? One man's meat is another man's poison. Melville and Shattock (*N.Z. Wheat Res. Inst.*, 1937) state that the effect of ascorbic acid is due to the formation of dehydro ascorbic acid by the action of an enzyme. Dehydro ascorbic acid is stated to be equal to bromate.

Schmidt has patented an improver made by swelling casein in alkali and then neutralising and drying. Hamburger and Co. have patented products made by treating casein with an organic base and neutralising with an organic acid. Fischer has patented the use of hydrogen peroxide and phosphoric acid in conjunction with a soluble bromide or iodide for flour improving. Kuhl recommends the use of lactic acid bacteria for the purpose. Hanff states that albumin degradation products such as peptones added to flour or dough have an improving effect. An excellent discussion on improvers in general was given by Muhlhause in the *Arkady Review* for October, 1937, p. 133. This is a paper well worth study.

In a review such as this, which is necessarily curtailed by considerations of space, much must be omitted. One would have liked to discuss new methods of fumigation such as the use of phosphine, chloropicrin and duracet oil; such problems as smut and bunt control with substances like sodium bisulphite or hydroxyphenylhydrazine. The vast progress in conditioning methods must be passed over as any discussion on this would occupy a whole review. The many researches on wheat germ, which is becoming an increasingly important commercial product, must be left alone.

The question of model milling and whether a short extraction, say in a Buhler or Brabender mill, gives as accurate an index of quality as does a commercial yield obtained on an Allis Chalmers mill, cannot be entered into. The writer can only apologise for these errors of omission in a necessarily abbreviated account of cereal chemistry progress in 1937.

Food Poisoning (*Continued from page 9.*)

foods—mostly milk products, particularly cream cakes or puffs—infected by a toxigenic staphylococcus. The circumstances have invariably been such to favour the multiplication of the organisms in the food prior to consumption. These outbreaks were studied by Jordan, Burrows, Dack, Woolhert, Dolman, and others. The experimental evidence that staphylococcal toxin does produce gastric irritation has been provided mainly by Jordan and consists in the production of the characteristic sickness and vomiting in human volunteers and in monkeys on the administration by the mouth of quite small doses. Jordan, in summarising the information, expressed the opinion that many staphylococcus outbreaks have probably been overlooked. These organisms are widespread in nature, which add much to their significance as food poisoning organisms and open up very considerable possibilities as a cause of obscure outbreaks.

In 1932 Savage delivered the Sedgwick Memorial Lecture in America, the subject of which was *Some Problems of Salmonella Food Poisoning*.

During recent years the subject of food infection and intoxication has received considerable attention in the annual reports of the Chief Medical Officer of the Ministry of Health. The numbers and particulars of the various outbreaks that have occurred during each year are given, together with other interesting and valuable information and advice. The following are the figures for the past nine years:

Year.	*Number of Outbreaks of Food Poisoning.*	*Deaths.*	*Number of Cases of Botulism.*
1927 ..	38	—	nil
1928 ..	45	3	nil
1929 ..	30	4	nil
1930 ..	22	16	nil
1931 ..	30	10	nil
1932 ..	30	8	nil
1933 ..	52	15	nil
1934 ..	46	6	nil
1935 ..	116	23	3

The incidence of food poisoning in America and Germany is considerably higher, especially in the latter country, on account of the large amount of uncooked meat which is consumed. In America, Jordan calculated that about 15,000 to 20,000 persons were attacked each year. The following table, which shows the incidence of food poisoning in Germany, following the consumption of meat and meat products, was compiled by Meyer in 1929:

Year.	*No. of Outbreaks.*	*Cases.*	*Deaths.*
1923 ..	76	3,746	28
1924 ..	62	1,712	21
1925 ..	83	1,905	22
1926 ..	84	2,679	17
1927 ..	110	3,548	27
1928 ..	78	977	18

Recent Developments in MEAT PACKING

C. Robert Moulton, Ph.D.

THE MEAT-PACKING industry of the United States has for many years made two claims to front-rank recognition. First, it has rather consistently been the country's largest industry when measured by the value of the products at the plant; and, second, it has claimed such great efficiency in the use of products and the working over of by-products that it has "saved everything but the squeal". These two claims might indicate that such a state of perfection had been reached that small opportunity for radical change exists in the industry. Yet developments of the past few years have shown that new materials and new methods are bringing about a revolution within this well-established industry.

New Curing Procedures

Foremost in this revolutionary process stands the art and science of meat curing. The use of nitrite of soda in place of all or a part of the sodium nitrate or other nitrate salt such as saltpetre, artery or spray pumping in place of very conservative pumping procedures, and large volumes of dilute pump pickles in place of small volumes of concentrated pickles has so greatly reduced the curing time that many hams are now prepared for consumption in as many days as the weeks once required. When curing depended upon the use of nitrate or saltpetre for the development of the normal red cured colour, some 60 days were required to cure a 14-lb. ham, and such a ham was too salty for use without parboiling. The direct use of nitrite, rather than waiting for it to be formed in the pickle, reduced the curing time to 40 days.

The older procedure required each ham to be pumped with 6 to 8 oz. of pump pickle of about 90° salometer. When nitrate is used in a pickle of this strength the reduction to nitrite is slow and the cure is delayed. Also the quantity of salt introduced into the ham by the usual pumping procedure is small and most of the curing ingredients must penetrate from the cover pickle employed.

The ideal to be sought in curing meat is the prompt and rather uniform distribution of curing ingredients throughout the meat in sufficient quantity to keep it and give the characteristic colour and flavour. Time is required to develop the normal flavour and texture of a fully cured ham, but a satisfactory flavour and texture can be developed within about 21 days in a 12 to 14 lb. ham by pumping much more generously with a more dilute pickle based on nitrite as the colour-fixing agent.

Much shorter curing periods are now being used by many meat curers to produce a mild, short-cured ham which meets the requirements of a large group of consumers. These short-cured hams are a bit light in colour and are very mild, but their flavour and texture are much more like a regular cured ham than is the case with such a product as the boiled ham of commerce. Short-cured hams are produced by using from 6 up to 15 per cent. of pump pickle varying in salometer from 50° up to 60° or 65° salometer. Nitrite is the chief colour-fixing agent, although some nitrate may be used; and a dextrose sugar in place of part of the usual sucrose sugar helps in giving a better colour.

New Smoking Methods

One disadvantage of many short-cured hams is the lack of good keeping qualities. The hams are inclined to be watery, and they must go into consumption promptly. These two disadvantages are largely offset by employing a revolutionary smoking procedure. Standard smoking methods involve a fairly cool smoking temperature (up to 135° F.) for 22 to 26 hours, which results in a smoking shrink of 5 to 7 per cent. Hams so treated reach a temperature inside the cushion of the ham of about 110° F. A tender, mild-cured, and ready-to-eat ham can be produced by pumping with 6 to 10 per cent. of 50° to 58° salometer pickles and curing for 12 to 15 days in a similar cover pickle. The hams are then smoked with the temperature in the smokehouse gradually being raised to 160° or 165° F. and continuing the smoking until the meat in the cushion of the ham reaches about 142° F. The heat of smoking results in a loss of weight that very nearly corresponds to the weight of the pickle added.

The loss of water which results from the hot-smoking and the cooking of the ham results in a product that keeps well and is ready to serve without further heating if it is desired. The ham may also be cooked for a sufficiently short time in order to warm it up and give the outside the finish so often desired in a baked ham. A ham of this type is mild as far as saltiness is concerned, and it has a ham flavour which is, however, not as characteristic as that of a 21-day or 40-day cured ham. It is also very tender, and, if the procedure has been properly carried out, it can be cut with a fork when sliced. It is not expected that this type of ham will replace the fully cured ham, but experience shows that there is a definite place in the meat trade for the new ham.

New Smokehouse Designs

One difficulty experienced in the use of the standard two to five story smokehouse is in controlling the shrink of the product being smoked. The location of the smoke-producing fires, heating coils, and product and the operation of the ventilators at the top are relied upon to give uniform heat and draught. Nevertheless, smoking losses vary, and differences in shrink as large as 11 per cent. have been obtained with a single batch of *frankfurters*.

One way to control the variation of shrink is to use the revolving smokehouse (Figs. 1 and 2), in which the product is carried up and down through the smokehouse on endless chains provided with crossbars on which the meat is hung. This ensures movement of air in all parts of the smokehouse and gives a more uniform loss. Another method is to apply the principle of air-conditioning to the smokehouse, controlling independently the temperature, humidity, smoke concentration, and air movement. At least two manufacturing companies have made installations of this sort, and one or two meat packers claim to have solved the problem for themselves.

One commercial unit designed especially for processing tender-cooked hams controls separately the humidity, temperature, concentration of smoke, and air-movement in a small movable metal chamber shown in Fig. 3. This apparatus is said to take sweet-pickle hams, which have been given a short, mild cure, and process them into cooked tender hams.

New Freezing Methods

The meat-packing industry has for a long time applied freezing as a means of keeping certain fresh meats for a longer time than can be done by chilling and storing. Freezing by low air temperatures is the principle that has been employed. This method seems to have little unfavourable effect upon lamb and mutton, but pork so frozen is altered sufficiently to require a different procedure when the meat is to be cured. Beef is affected so that it tends to drip or ooze out a reddish serum when it is cut after thawing. The damage done is largely a result of the effect of large ice crystals upon the muscle fibres, and this cannot be avoided when meat is frozen slowly, as it can be when air methods are used.

Two different types of process are now being employed to quick-freeze smaller pieces of meat such as steaks and small roasts as well as chicken, fresh vegetables, and fresh fruits. One method, the Birdseye Process, employs metal belts, chilled by brine to a temperature of $-50°$ F., and thin pieces of meat are brought into more or less intimate contact with two such belts. A rapid freezing with very small ice crystals results. Another process, the Z-Process, employs a very cold spray of brine as the cooling medium. The meats (chicken, for example) may be frozen without protection or the product may be placed in metal containers so that the brine does not strike the meat. Neither of these methods is being employed to any extent as yet with packing-house products, although some meat packers have experimented with them. They are being used, however, in increasing volume with fish fillets, chicken, fresh vegetables, and fresh fruits.

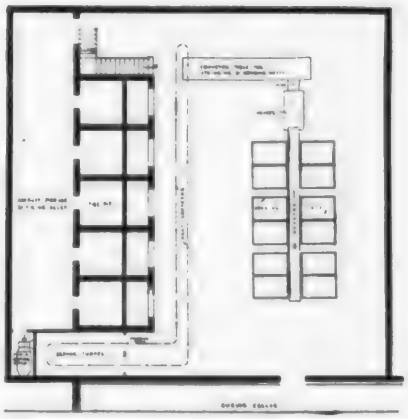


FIG. 1.—Plan of 5-section revolving smokehouse. (*From Pork Operations, Institute of Meat Packing. Reproduced by courtesy of Albright-Nell and the I.M.P.*)

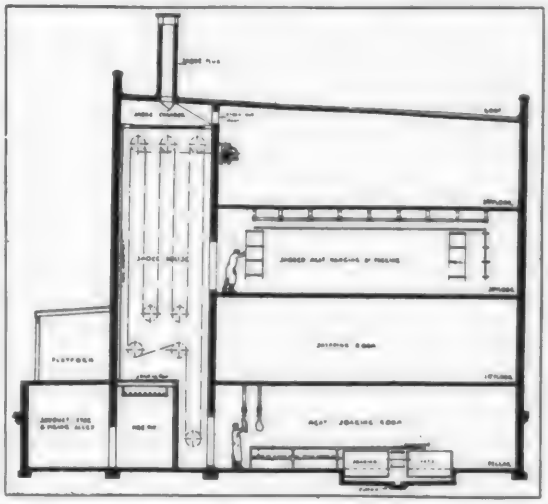


FIG. 2.—Section through a revolving smokehouse. (*From Pork Operations, Institute of Meat Packing. Reproduced by courtesy of Albright-Nell and the I.M.P.*)

Chilling Fancy Meats

Fancy meats and sausage meats are especially difficult to handle in chilling. Some of the sausage meats, such as beef cheeks, require washing and rapid chilling if one is to keep the numbers of bacteria per gram to a low level. Since these meats are small in size, they are apt to be held on the dressing floor for longer periods of time than are good for them.

A recent development that offers great promise of solving the problem is the application of a chilling tunnel to the cooling of such meats. An endless belt is passed through a tunnel where rapid chilling is accomplished. The meats are washed when necessary and are deposited on the belt as they are produced on the slaughter floor. One or two installations of this kind have been made in meat-packing plants, and more are sure to follow.

Transparent Cellulose Labels and Wrappings

A transparent cellulose product in the form of an artificial sausage casing, a wrapping paper, or a lithographed label has many advantages, one of which is visibility of

FIG. 3.—Movable metal chamber.

the product contained in the casing or wrapper. There have been two recent new applications of this sort to carcass meats. An American meat packer is applying to his fancy lamb and mutton carcasses a lithographed label which carries in colourful manner the packer's brand and a short description of the product.

Another application has been made by the same company to veal carcasses, as shown in Fig. 4. These are customarily sold to the retailer still with the hide since the skinned carcass dries out rapidly and becomes unattractive. The company in question removes the skin from the calf carcass at the slaughtering plant and then wraps it with an endless strip of transparent cellulose that is 5½ in. wide and is overlapped ½ in. in applying. A printed label is applied before the wrapping. The innovation makes a carcass with an attractive appearance, which keeps its colour.

New Pumping Procedures

Reference has been made in the foregoing to differences in the methods of putting pickle into a ham to be cured. Standard procedures have employed 90° salometer pickles and two "strokes" delivering from 2 to 4 oz. each into the shank of a 12 to 14 lb. ham. As the size of the ham increases additional "strokes" are given, and in other parts of the ham such as the butt and the blood vein.

The shorter cures employ two methods of putting more pickle into the ham. The first method involves a stroke delivering a smaller volume of pickle at one time and the inserting of the pumping needle into more parts of the ham so that a greater total quantity of pickle is used and in more widely distributed locations. A modification of this principle is called "spray-pumping," which employs a needle with a number of holes through which the curing solution is forced as a spray into the ham.

The second method is the use of the circulatory system of the ham in the so-called "vein-pumping". For success this method requires the leaving on the face of the ham at the time of slaughter a longer end of the artery which feeds the ham. Into this artery the pumping needle is inserted, and the curing solution is forced under pressure into the arteries and veins of the ham. In theory this is the ideal method of getting rapid and uniform distribution of curing pickle into a ham. However, some operators find the method to be less satisfactory than others, and so they use one of the methods described above.

In both of the pumping methods just outlined a greater volume of dilute pickle is pumped into the ham. Six per cent. of pumping pickle would mean from 12 to 14 oz. in a 12 to 14 lb. ham; 10 per cent. would involve 19 to 22 oz.; and 15 per cent. would mean 29 to 33 oz. Not many operators use as much pickle as 10 to 15 per cent. since such a procedure puts too much water into the ham.

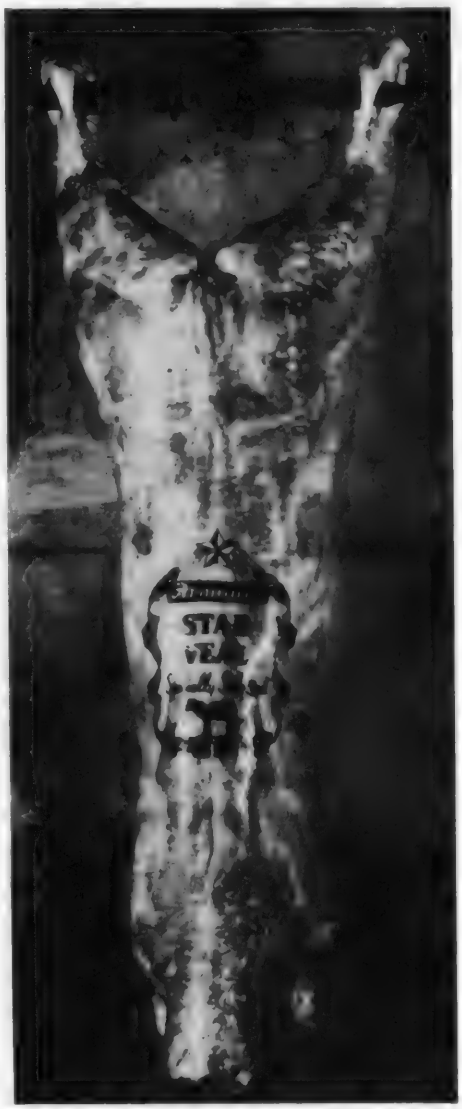


FIG. 4.—Veal wrapped in transparent cellulose.

PLANT AND MACHINERY

Food manufacturers find the British Thomson-Houston slip-ring motor rated at 55 h.p., and giving 580 r.p.m., a useful addition to their plant, either replacing an older type or as a completely new venture. This particular model is installed in a corn mill, and is only one of the many supplied in 1937 to the food industry.

Glass Kitchen Equipment

Heat-proof and fire-proof Jena glass is now being used for domestic utensils so extensively that it is probable that a huge display known as the "glass kitchen" and the "glass table" will be a prominent exhibit at the Leipzig Spring Fair. The "glass kitchen" refers to all conceivable kitchen utensils used for frying, roasting, steaming, and baking and the "glass table" to dinner and soup plates, gravy boats, milk jugs, and other tableware all made in this new refractory glass.

* * *

Thermometal

Henry Wiggin and Co., Ltd., have recently concluded arrangements with the H. A. Wilson Co., of Newark, New Jersey, which will enable them to manufacture this firm's complete range of Thermometal products at their Birmingham works. These products will be known collectively as Wilco-Wiggin Thermometal and are claimed to be able to solve the temperature control problem which is often a vexing question with manufacturers. Booklet No. TH2 explains the whys and wherefores of Thermometal and is available from Henry Wiggin.

* * *

Processing and Pressure Control

The Short and Mason universal system of automatic temperature and balanced pressure control makes it possible to process glass packages with light aluminium caps without losses due to distorted or blown caps. The same equipment also eliminates buckled and panelled cans caused by retort shocks when large and irregularly shaped cans are being processed. The temperature and pressure are automatically controlled by this efficient system which operates within 1 lb. of the schedule best suited to the conditions. Guesswork and uncertainty are, thereby, largely eliminated. Even if the cooking in the tins is done by live steam and not water, the system operates equally well, which is a notable advantage.

* * *

New Ultra-Violet Photometer

Adam Hilger, Ltd., have produced a simpler and cheaper design of their Spekker ultra-violet photometer. They have called it the Spekker Minor Ultra-Violet Photometer, and claim that it is closely similar in principle to its more elaborate prototype. The maximum length of liquid tube which can be used is, however, 4 cms. only and the instrument must be used with tubes of equal length not exceeding 40 mm. Apart from these limitations, however, the instrument is similar in accuracy to the larger Spekker photometer, and it is fully described in leaflet No. 238, published by Adam Hilger, Ltd.

A Modern Cereal Laboratory

The illustration shows an up-to-date cereal laboratory equipped with the latest types of cereal testing apparatus, including the Brabender Farinograph used for testing the physical properties of flour doughs. All the apparatus was supplied by Henry Simon, Ltd., the well-known firm of flour milling engineers, of Cheadle Heath, Stockport.

On the small bench in the foreground is a Carter-Simon rapid moisture tester together with two auxiliary pieces of equipment. Of these, that on the left is an interval signal clock for giving audible warning when the samples should be placed in the moisture tester, and that on the right is a small electric laboratory grinder used to reduce granular samples to a fine state of division for the moisture test.

Over seven hundred Carter-Simon moisture testers are now in use for testing a wide range of materials such as flour, wheat, tea, tobacco, soap, sugar, etc. This apparatus successfully overcomes the disadvantages associated with previous moisture-testing ovens in that it gives reliable and uniform results in a fraction of the time previously required. The actual testing time has been reduced to fifteen minutes or less according to the type of product.

On the right-hand side of the laboratory is a "Simon" thermostatically controlled baking oven arranged on top of a "Simon" thermostatically controlled fermentation and proving cabinet. These two pieces of equipment, which have only recently been placed on the market, have been evolved in order to obviate the faults associated with earlier equipment—namely, variations in temperature during baking tests.

This equipment is already in use in certain bakeries, and is used for other purposes than the direct testing of flour purchases. In one plant bakery samples of dough which have passed through the fermentation rooms and proving chambers, under commercial conditions, are baked under perfect temperature control in the oven; alternatively, doughs are fermented and proved under laboratory control conditions in the lower cabinet and then passed into the bakery to be finished in the bakery travelling oven.

Eight specially designed heating elements are arranged in the oven in parallel round the sides and base. The elements are screwed on to heavy insulated busbars.

Heat circulation in the oven is so arranged that top heaters are unnecessary and, therefore, there is no direct heat on the top of the dough. By this means the final bread produced is a true indication of the natural spring of the dough and all pulling of dough is avoided. Another advantage of this system is that burnt tops are eliminated and the colour of the crust is definitely associated with the ripeness of the dough. The colour is not exaggerated by over-heating of the top crust as frequently occurred in previous types of ovens.

The heavily tiled sides and sole offer great heat retaining properties, and the temperature drop on inserting test bakings is remarkably small. In addition the oven is lagged with a thick layer of special insulating material which reduces heat loss to a minimum.

The all-metal thermostat control employed has only one moving part and all contact surfaces are large and self-cleaning. By the use of the oven and prover it is very often possible to check faults in the actual bakery plant which are otherwise very difficult to find.

* * *

Mono Containers

A specimen of the new manufacture and printing of Mono containers has been received which amply demonstrates the neatness and lightness of this product. A special department of Mono Containers, Ltd., creates individual designs to suit all needs.

* * *

A New Albro Filler

Filling machines for sauce, milk, wine, powders, and many other commodities are manufactured by Albro Fillers and Engineering Co., Ltd., and a new machine of exclusive design is the latest product of this concern. This machine is a 24-head rotary filler for pasteurised milk such as was displayed at the recent Olympia Dairy Show, and its exclusiveness lies in the fact that it fills the milk under a low vacuum to an exact level in the bottle without the slightest waste or dripping. Leaky bottles are automatically rejected.

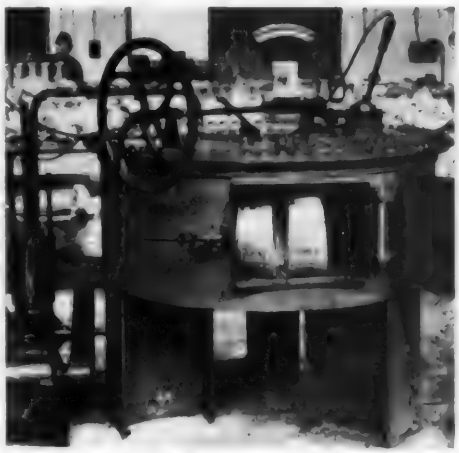
Many well-known dairies have placed advance orders for this new filler.

* * *

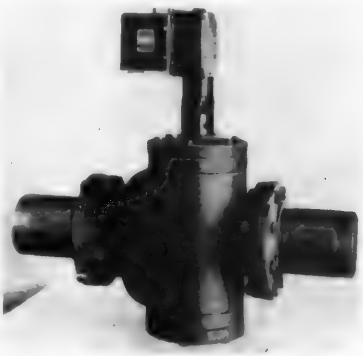
Motorised Valve

A valve which represents a new departure is the motorised valve made by Honeywell-Brown, Ltd. It is a modulating or gradual action type and can be used either with or without the motor. The valve is chiefly used for modulating the flow of steam, liquids, or gas.

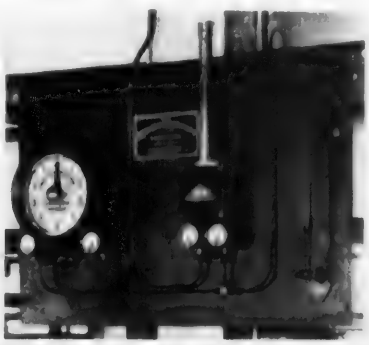
Here is the cereal laboratory and test bakery which is comprehensively described above.



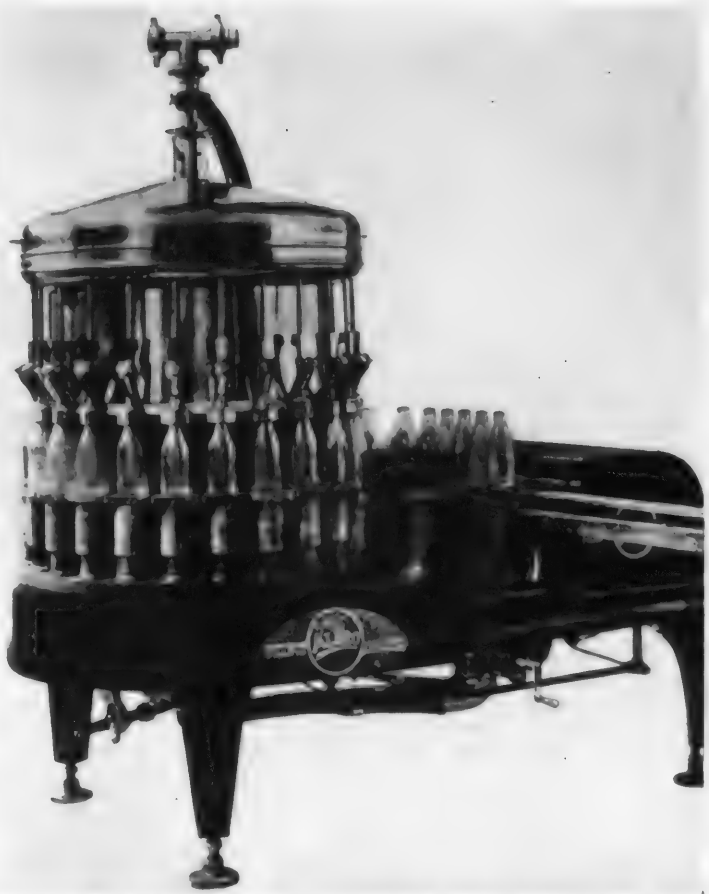
J. C. Wetter's vacuum soldering machine detailed overleaf.



Honeywell-Brown's new motorised valve referred to on the opposite page.

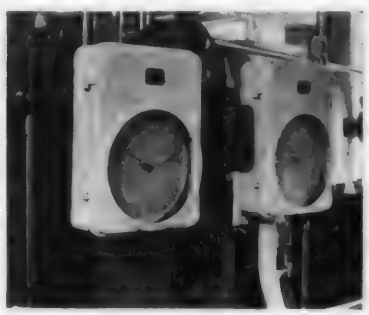


Automatic temperature and humidity control is essential in the modern food factory: here is an instrument which records both, made by the firm of Negretti and Zambra.



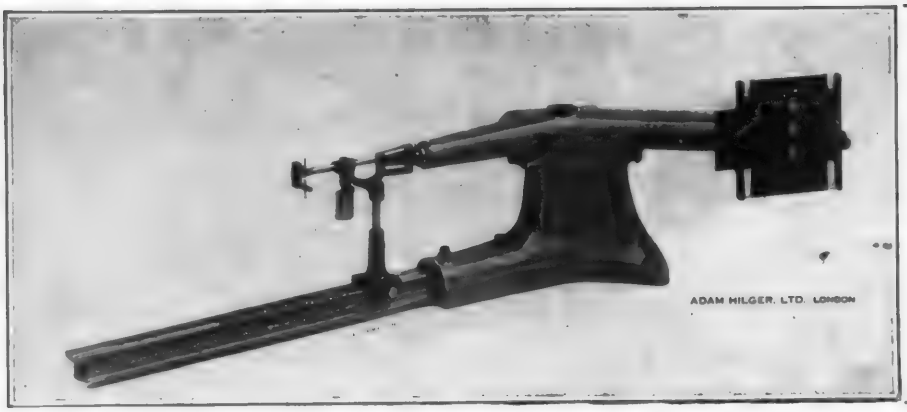
Precisely filling 24 bottles a time, automatically rejecting leaky bottles; this is the performance of the new Albro filler pictured above and described on the opposite page.

Modern lighting with Benflux fittings made by the Benjamin Electric Ltd., has reduced glare to a minimum in this "Hovis" bread mill. The lamps are 60 watt, the area covered by each is 71 sq. ft., and their height above the working plane is 4 ft., 7·5 ft. C.



Dairy thermometers at a modern Richmond dairy which are described overleaf.

Here is one of the latest installations by those well-known food plant engineers, Robert Kellie and Son, Ltd. It is a continuous hydro-electric washing, rinsing and drying plant for bakers' boards, tins, trays, and other equipment.



Adam Hilger's new photometer, a simpler and cheaper design of the Spekker instrument. Details are on page 19.

Adana Printall Offset Printer

Designed for commercial use by manufacturers and retailers of packed, canned, or bottled goods, the Adana Printall offset printing machine is so constructed as to be able to print on solid articles and substances as diverse in nature as glass bottles, collapsible tubes, tin or metal canisters, moulded goods, etc., and on practically any shape or texture.

In appearance it is miniature to a standard platen printing machine, but the hard steel platen, on which the paper is ordinarily laid, is replaced by a pad of special resilient composition which takes the print from the type or engraved block in the type-bed. The articles to be printed are pressed on to or rolled over the platen pad, and the impression is thus "offset" on to them. It is a simpler, speedier, and more economical method of printing on the diverse substances mentioned; it is more permanent than transfers.

Special inks have been developed which will not wear off or scrape off easily, and which will stand any amount of washing in hot soapy water—thus the process is ideal for moulded beakers, glass jars, etc. Collapsible tubes and tinplate canisters are not beyond the scope of this machine. We have seen remarkable samples of such printing, which has a singularly high standard of efficiency. It is ideal for small quantities of collapsible tubes. Filled as well as empty containers can be treated with equal ease. Girl labour is suitable for operating the machine, which can be worked to give approximate production speed of 4,000 to 5,000 units per day. An illustrated booklet can be obtained from Adana, Ltd.

* * *

Dairy Thermometers

The Bristol Instrument Co., Ltd., are the makers of a dairy thermometer which, it is claimed, tells the chemist at once whether or not the pasteurising temperatures and hold periods are satisfactory. The installation we illustrate is by the A.P.V. Co. at a Richmond dairy. Here the cold milk recorder and recorders for hot milk leaving the "Tarbet" holder are used so that the temperatures are recorded at three vital points.

* * *

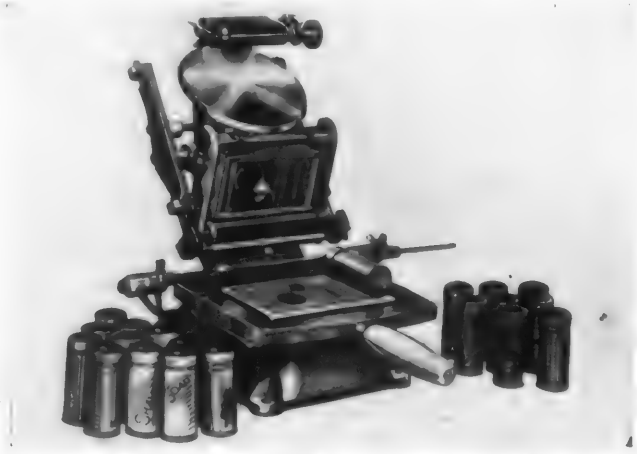
Soldering under Vacuum

Details of the vacuum soldering machine for meat preserving in tins come from J. C. Wetter and Co. The hams, or the other meats, are placed in the tins, the lids are then soldered on, and a ventilation hole is left in them. They are then placed into the machine and when the desired degree of vacuum is reached, the tins are soldered, while still under vacuum, by means of an electric soldering iron. Sixty large ham tins is the capacity of each of these machines, which have two electric soldering irons fitted on the larger types.

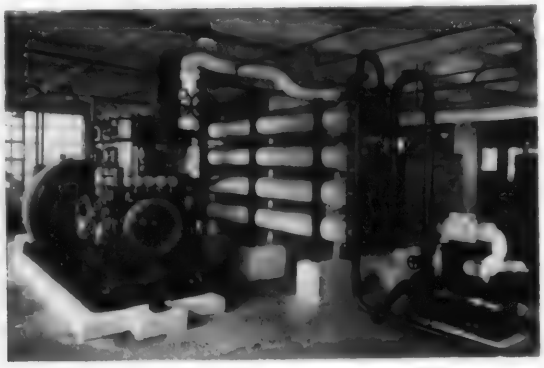
* * *

Special Wagons for Fragile Freights

First introduced 18 months ago, the G.W.R. partitioned goods wagon has proved so successful in reducing damage in transit to soft fruit and fragile freights such as eggs, that the company has decided to build 50 more vehicles. At present there are 165 in use.



It prints on all surfaces! The new Adana machine described above.



A twin cylinder vertical enclosed high speed ammonia compressor installed in the Southern Oil Co., Ltd., producers of edible fats, by J. and E. Hall, Ltd.

End of FOOD MANUFACTURE *Annual Review*

Flat Sour Thermophiles.

L. H. G. Barton, B.Sc., A.I.C.

discusses

THERMOPHILES

AND THEIR IMPORTANCE

TO CANNERS

We predict a more intensified attention this year towards the problem of organisms in commonplace ingredients entering food products. **The Author** here makes an important contribution to this subject which may possibly cause a flutter among the dovecotes of the canning fraternity. Manufacturers have, on the whole, assumed that the more common components of their packs are without reproach, but in future the bacteriologists will be busy. This year should bring forth some interesting facts along the lines of the author's investigations.

WITH THE continued growth of the canning industry in this country more attention will be directed towards thermophilic organisms than they have hitherto received. If information regarding thermophiles is required it will nearly always be found in American literature. This is because thermophilic spoilage in canned foodstuffs has been investigated more fully in America than in any other country. The closeness of the investigation has been such that definite standards concerning the thermophilic contamination of certain raw materials have been established. These will be discussed later, and it is the purpose of this article to acquaint those who supply canners with raw materials with what is expected of their products from one bacteriological point of view.

Thermophiles are so called because they are "heat-loving" bacteria. Their optimum growth temperature is 55° to 60° C., but, however, they should not be confused with thermoduric organisms. The former thrive at relatively high temperatures from choice and not necessity, while the latter gradually acquire the property of withstanding such temperatures. Thermophiles are spore-forming bacteria which are present in soil, water, and dust, and in this country they are more likely to be found as spores than vegetative forms since the temperatures are generally unfavourable to their growth. They have been divided into three groups according to the type of spoilage they produce in canned foods. These groups are now recognised as:

1. Flat Sour spoilage bacteria, which produce acid without gas, the ends of the can remaining flat.

2. Thermophilic anaerobic bacteria, which produce acid and gas (mainly CO_2 and H_2), the can becoming swelled.

3. Sulphide spoilage bacteria, which are thermophilic anaerobes but which differ from 2 in producing hydrogen

sulphide. These cause blackening of the product, but the ends of the can remain flat owing to solution of the gas in the can contents.

Thermophiles are important to the canner because their spores are the most heat-resistant spores known. They will survive more rigorous processing than do the spores of *B. botulinus*, and if a canner gives his pack a processing which will render it *botulinus*-free, it by no means follows that all thermophiles will be destroyed. It should be noted, however, that thermophilic spores are non-pathogenic. Esty and Meyer[1] reported the following requirements for the destruction of *B. botulinus* spores in a phosphate medium of *p*H 7.

4	minutes at	120° C.	(248° F.)
10	,, ,,	115° C.	(239° F.)
32	,, ,,	110° C.	(230° F.)
100	,, ,,	105° C.	(221° F.)
330	,, ,,	100° C.	(212° F.)

Werkman[2] gives the following figures for the resistance at *p*H 7 of the spores of *Clostridium nigrificans*, a thermophile responsible for sulphide spoilage,

7- 10	minutes at	120° C.	
11- 13	,, ,,	118° C.	
450-480	,, ,,	100° C.	

while Donk[3] gives the T.D.P. of *B. stearothermophilus*, a flat sour organism in a medium of *p*H 6-6·1 as,

11 minutes at 120° C.
17 hours at 100° C.

It has been found that some thermophilic spores have survived a processing where the can centre received 25-30 minutes at 240° F. The *p*H of all these products was within the limits 6·4-6·8.

Two of the factors which influence the effectiveness of a processing of slightly acid products are:

1. The bacterial load of the product just before processing.
2. The presence of salt in the product.

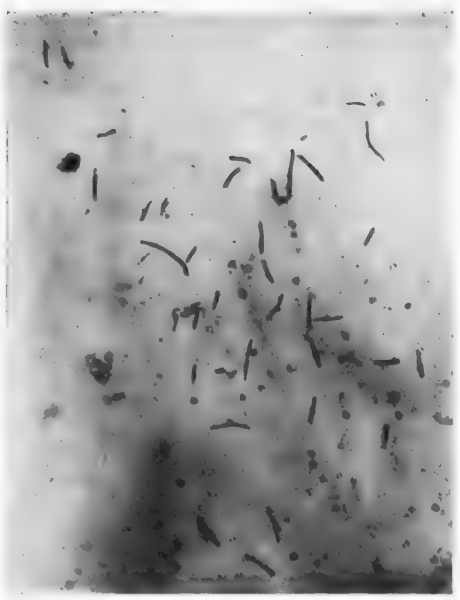
The effect of bacterial load has been studied by Cameron and Yesair[4] who processed at 250° F. pea purées containing:

1. No sugar.
2. Sugar A with very low flat sour contamination.
3. Sugar B with very high flat sour contamination.

250° F.	*Spoilage.*		
	No Sugar.	*Sugar A.*	*Sugar B.*
70 mins.	0	0	95·8 per cent.
80 ,,	0	0	75·0 ,, ,,
90 ,,	0	0	54·2 ,, ,,

(Sugar A had about 60 flat sour spores per 10 grams.)
(Sugar B had more than 2,000 flat sour spores per 10 grams.)

[1] J. R. Esty and K. F. Meyer, *J. Inf. Dis.*, 31, **650, 663.**
[2] Bacteriological Studies on Sulphide Spoilage of Canned Vegetables. C. H. Werkman, 1929, *Iowa State Agr. Exp. Sta. Bull.*, 117.
[3] A Highly Resistant Thermophilic Organism. P. J. Donk, *J. Bact.*, 1920, **5**, 373.
[4] About Sugar Contamination: Its Effect in Canning Corn. Cameron and Yesair, *Canning Age*, 1931, **12**. 239.



Swell Thermophiles.

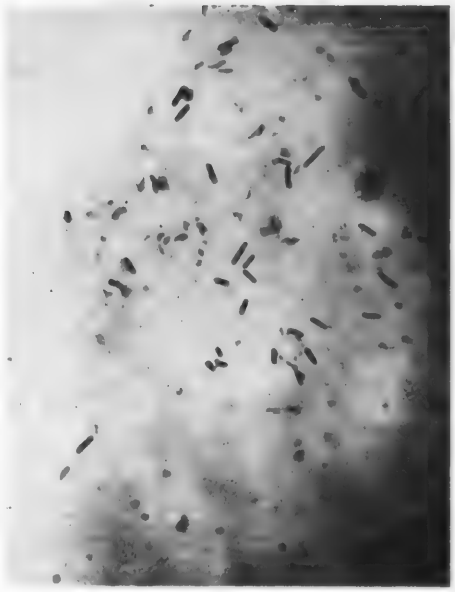
The presence of salt increases the resistance of the spores as shown by Viljoen,[5] 30 minutes' processing of pea liquor at 239° F. without salt was shown to give sterile product, whilst 1·5 per cent. of salt in the liquor made the processing only 92 per cent. effective. The most protection is afforded by concentrations of 1-2·5 per cent. salt and a protective effect is noticed up to 3-3·5 per cent.

Thermophiles grow best at 130° F. (55° C. approx.) and some require temperatures greater than 100° F. to grow at all. These temperatures are possible in tropical and sub-tropical climates, or in unsuitable storage places —*e.g.*, next to boilers, steam-pipes, radiators, etc. Werkman[2] states that *Clostridium nigrificans* grows best at *p*H 7·2-7·4 with limits of *p*H 5·8-7·6. It therefore follows that only the slightly acid products are susceptible to spoilage. There is no blackening, for example, in canned foods of *p*H less than 5·8.

The typical flat sour condition is that of a non-gaseous fermentation with odour very slight or entirely lacking. Starchy products may become sloppy because flat sours sometimes give rise to starch-splitting enzymes. The *p*H of the product is reduced to approximately five, and a milky pack presents a curdled appearance. Since the ends of the can remain quite flat, it is very possible that a grocer would sell a flat sour as a perfectly good pack. Thus it is that a consumer may open a can which outwardly appears good and finds the contents in a spoiled condition.

The "swell" or can blown due to thermophilic anaerobes, whilst constituting a loss to the canner, is not so likely to reach the consumer because most grocers are aware that a blown can is unfit for sale. The sulphide spoilage anaerobes cause spoilage due to gas production, but the can does not swell since the hydrogen sulphide dissolves in the contents. An odour of bad eggs is noticed

[5] The Protective Effect of Salt on Bacterial Spores heated in Pea Liquor. J. A. Viljoen, *J. Inf. Dis.*, 1926, **39**, 286.



H_2S-forming Thermophiles.

on opening the can; sometimes the odour is strong and at other times not so marked. The putrefactive odour of protein decomposition is not detectable since the organism has only a feeble proteolytic action. The blackening which accompanies this type of spoilage is readily differentiated from "chemical" discoloration by the appearance and uniformity of the blackening throughout the contents of the can.

The question now arises—how is this type of spoilage to be overcome? A solution might be found by increasing the temperature and/or time of processing, but if either of these factors is increased it is very possible that the appearance and flavour of the pack will be altered or even spoiled. An increase in acidity would assist the destruction of thermophilic spores, but this would almost certainly alter the flavour, and very likely the appearance of the product. An agitation or rotation of the can during processing might be given to heavy packs to increase the rate of heat penetration, but this kind of treatment is not always beneficial from other points of view. Rotation of the can during the heating process sometimes results in partial disintegration of some of the constituents of the pack—*e.g.*, peas, beans—with considerable thickening of the liquor due to liberated starch.

It is apparent that much difficulty will be experienced with most products if an attempt be made to destroy all thermophiles in the pack by the final processing. Bearing in mind the figures quoted for the influence of bacterial load on processing it would appear that a consideration of two other aspects would provide a solution. These are:

1. A strict bacteriological control of manufacturing processes.

2. A careful bacteriological control of all raw materials.

In the first case the necessity for bacterial control has been demonstrated by a detailed examination of a cannery plant. This examination, which is reported by Cameron, Williams and Thompson,[6] shows that thermophilic contamination was found in such articles of equipment as wooden tanks used in the preparation of brine, or for storage of hot water. Blanching, preheating and filling equipment were also found to be capable of harbouring contamination.

In the second case, bacteriological examination of the raw materials seems to have been confined to sugar and corn starch according to published data.[3, 6, 7, 8, 9] Numerous other raw materials which might be used by canners have been examined in these laboratories and some have shown high contamination with thermophiles. Noteworthy instances are those of mushrooms, rice flour, rice and arrowroot. Flat sour contamination appears to be the kind of infection present in greatest abundance. Corn syrup and golden syrup are derived from corn starch and sugar respectively, and it is not surprising, therefore, that they possess similar contamination with thermophiles. The results of these examinations are given in the accompanying table.

Pioneer work has been done by the Research Laboratories of the National Canners' Association in Washington, to improve the quality of sugar and starch supplied to canners. After considerable experiments this Association made the first statement of bacterial standards for sugar in 1931. This work led to a desire on the part of canners to buy sugar that had been tested for suitability for canning. Sugar refiners began investigational work in their refineries and some announced that they would be able to supply sugar which would conform to the standards laid down by the Association. Modifications have since been made in technique for the detection of thermophiles, and in standards, with the result that the American canners can order their supplies of sugar to the following specification.[10]

Standards for Sugar

Total Thermophilic Count.—For the five samples examined there shall be a maximum of not more than 150 spores and an average of not more than 125 spores per 10 grams of sugar.

Flat Sour Spores.—For the five samples examined there shall be a maximum of not more than 75 spores and an average of not more than 50 spores per 10 grams of sugar.

Thermophilic Anaerobic Spores.—These shall be present is not more than three (60 per cent.) of the five samples and in any one sample to the extent of not more than four (66 per cent.) tubes.

Sulphide Spoilage Spores.—These shall be present in not more than two (40 per cent.) of the five samples and in any one sample to the extent of not more than five spores per 10 grams.

The specification which applies to starches is confined to the flat sour spores and thermophilic anaerobic spores. These are the same as those for sugar.

[6] Bacteriological Field Studies in Canning. Cameron, Williams, and Thompson, *National Canners' Assoc. Bull.*, 1928, No. 25L.

[7] The Thermophilic Flora of Sugar in its Relation to Canning. Cameron and Williams, *J. Bact.*, 1928, **15**, 31.

[8] Thermophilic Bacteria in Refined Cane Sugars. Owen and Mobley, *Ind. Eng. Chem.*, 1932, **24**, 1042.

[9] Thermophilic Canned Foods Spoilage Organisms in Sugar and Starch. Clark and Tanner, *Food Res.*, 1937, **2**, 1.

[10] Bacterial Standards for Sugar (to supersede Bact. Stds. for Sugar, 1932). *Natl. Canners' Association Res. Labs., Washington, D.C.*

It will be seen from the table that the average figures for English sugar and syrups found by the standard method are far in excess of those given in the American specification. Arrowroot, cornflour, patent flour, and riceflour are also outside the specification for starches on the average. In order to check the report that American "canners'" sugar has a low thermophilic count, a barrel of sugar from America was examined and the following are the results of the duplicate examination:

Examination.	*Total Thermophiles per 10 Grams.*	*Flat Sour Spores per 10 Grams.*	*Swells out of 6 Tubes.*	*Sulphide Formers per 10 Grams.*
1	0	0	1	0
2	0	0	0	0

In this connection various publications[11, 12, 7] have appeared, and it appears that the stages in sugar refining which are most effective in eliminating thermophilic contamination are filtration and crystallisation, but in a measure every refinery may be considered to present a special problem, and the problem in every instance will have to do not only with removal of thermophilic bacteria but with prevention of accumulation. Cornflour is also available in America with very low thermophilic contamination. This has been achieved without loss of gelatinising power.

Thus it is that America has solved the thermophilic problem with regard to sugar and cornstarch. A very wide field of research still remains open for the investigation of the sources of contamination of all other raw materials used by canners, and methods have still to be found whereby thermophilic contamination can be considerably reduced. In England we have not yet solved our sugar and starch problems. The writer knows of one sugar concern and one starch company in England who have made investigations in this connection and have met with some success. These are exceptions. Is it not time that more attention should be paid to thermophilic contamination in this country?

[11] Elimination of Thermophilic Bacteria from Sugar. E. J. Cameron and W. D. Bigelow, *Ind. Eng. Chem.*, 1931, **23**, 1330.
[12] Thermophilic Contamination within the Sugar Factory. F. R. Calton, *Ind. Eng. Chem.*, 1936, **28**, 1235.

THERMOPHILIC CONTAMINATION IN ENGLISH RAW MATERIALS.

Raw Material.	*Number of Examinations.*	*Total Thermophiles per 10 Grams.*			*Flat Sours per 10 Grams.*			*H_2S-forming Anaerobes per 10 Grams.*			*Gas Formers per 6 Tubes.*		
		Min.	*Max.*	*Average.*	*Min.*	*Max.*	*Average.*	*Min.*	*Max.*	*Average.*	*Min.*	*Max.*	*Average.*
Arrowroot	22	10	1,550	200	8	1,550	150	—	—	—	1	2	Often absent
Cornflour	30	150	U*	8,150	—	U	4,000	—	—	—	0	6	Often absent
Corn syrup	8	45	295	205	40	295	175	0	25	—	0	4	Often absent
Demerara sugar ...	6	75	135	113	30	370	610	—	—	—	2	3	Often absent
Farina	6	0	35	16	0	25	10	—	—	—	0	1	Nearly always absent
Golden syrup	12	90	3,750	1,465	0	550	75	0	U	165	0	6	Nearly always present
Patent flour	22	10	970	175	10	635	72	—	—	—	0	1	Nearly always absent
Rice flour	33	25	1,100	135	20	800	155	—	—	—	0	4	Nearly always absent
Granulated sugar ...	22	60	23,750	3,550	0	12,050	140	0	U	42	0	6	Nearly always present
Mushrooms	7	90	4,585	655	60	3,000	593	0	0	0	0	0	□
Hand-shelled peas ...	4	0	115	40	0	115	40	—	—	—	—	—	—

* U = Uncountable, very high.

Promotion of Health in the Empire Citizen

AT a recent lecture given at Manson House on this subject, Dr. Bernard Myers, C.M.G., F.R.C.P., Consulting Physician to the New Zealand Government in London, said: "The future of the far-flung British Empire depends chiefly upon the standard of health obtaining among the people living in Great Britain and Ireland, the Dominions, India, Colonies and the Dependencies. Health depends upon certain physical and mental qualities, but, in addition, suitable feeding, fresh air, sunlight, sanitary homes, appropriate clothing, sensible upbringing, physical and mental training, and the avoidance of infectious and other diseases that interfere with the maintenance of good health, are of the utmost importance."

The lecturer traced the steps taken for the provision of water supply and food, the making of paths and wharves and the establishment of grazing ground for cattle and sheep in New Zealand.

After giving various other figures, Dr. Myers said, on the subject of nutrition, "New Zealand closely abides by the statement of Sir George Newman that 'Good nutrition promotes good growth'".

He made reference to the Annual Report of the Division of School Hygiene in New Zealand, and argued that as food in New Zealand is relatively cheap and well within the purchasing power of all classes of the community, more knowledge and intelligence are required in the choice of food and particularly in its preparation.

He said that the average consumption of milk in New Zealand had increased from half a pint per person to five-eighths pint per day, as the result of widespread propaganda and the schemes for milk distribution at school.

The average annual consumption of certain other articles of foodstuffs and the amount available for local consumption, per head, were cited as butter 40 lbs., cheese 5 lbs., fresh beef 117 lbs., fresh mutton 87 lbs., fresh pork 6 lbs., bacon and ham 11 lbs., sugar 104 lbs. and potatoes 181 lbs.

Book Reviews

A Concise Pharmacology

A primary requirement of a technical book is precision of subject matter coupled with an adequate briefness of dissertation. In this respect the authors of *A Concise Pharmacology* have triumphed, as they have done in their arrangement and grouping of the drugs—always a difficult matter in pharmacological works. It is a new type of textbook for pharmacists, medical men, nurses, and manufacturing chemists, and covers more than adequately the most important drugs used in the British Commonwealth and the U.S.A.

For the convenience of students some sections are set in smaller type; in the main these relate to less important drugs, of which no detailed study is required. Profusely indexed, the book is interleaved in order that notes, etc., may be added from working experience. Definitions, a list of abbreviations, and drug incompatibilities head the work, which opens with a chapter on the alkalies. An outstanding feature is that drug action in relation to practical therapeutic use is fully discussed and specimen prescriptions are given. The modernity of the book is indicated by a chapter covering colloid medicine. The authenticity of the work is assured by the authors' qualifications and experience. F. G. HOBART is a pharmacist with clinical acumen, while G. MELTON is a physician with exceptional pharmacological experience.

This book is a necessity for all who are in any way connected with pharmacy and the fine chemical industry. It is an asset on the library shelf; it is essential for the desk of the practical worker.

P. L.

A Concise Pharmacology. By F. G. Hobart, Ph.C., and G. Melton, M.D., M.R.C.P. With a foreword by Adolphe Abrahams, O.B.E., M.A., M.D., F.R.C.P. Pp. 174. *Leonard Hill Limited, London.* 1937. 7*s.* 6*d.*

Two Monumental Books

The revised edition of CAMPBELL'S book has recently been published. This mighty example of the literature of canning and preserving runs into no less than 848 pages. Its general treatment is that of a recipe book, and the eight pages constituting the introduction deal with many general subjects.

There are six sections under the headings of Canning, Preserving, Tomato Products, Condiments and Sauces, and Miscellaneous Products.

In Chapter 1 the fruits are arranged in alphabetical order. Chapter 2 deals with vegetables, pressure cookers, the making of brine, acidification, etc.

It is interesting to note that under "Meat and Meat Products" and "Chicken and Chicken Products" there is no other indication than the following: "These products should not be packed without the directions from a research laboratory connected with the canning industry". The omission is well justified, as these products cannot be covered by recipes, although some general principles might have been included.

Chapter 3 deals with beans and sauces, soups, spaghetti, macaroni and cheese, etc. This section is almost entirely composed of recipes.

A useful appendix is provided, showing the weight of canned food products in various sized cans. Section 2 is devoted to preserving and jellies, fruit juices and jellies, which are treated at some length, as also are jams.

Crushed fruits and fountain supplies, and also fruit syrups, crystallised and glacé fruits, conclude the second section.

Tomato products occupy the third section, which comprises a very complete general review, and runs into 100 pages.

Section 4 deals with pickling. The treatment here is from a general point of view, although there are a number of recipes.

Section 5 deals with condiments and sauces in quite an adequate manner. One quite important part, dealing with vinegar, mayonnaise and salad dressing, is usefully discussed.

The last section deals with Miscellaneous Products, including mincemeats, syrups, salad oil, peanut butter, etc.

The bibliography is useful and contains reviews as recent as 1936. It is interesting to note that FOOD MANUFACTURE has been freely culled from.

Another monumental work is by A. W. BITTING, M.D.

The different sections of this book are written by various experts, and the treatment is very complete, comprising as it does the historical, statistical and technical aspects. Fruits, vegetables, meats, syrups, and milk are all treated.

In the meat-canning section is omitted the mention of the production of meat extract as a by-product from corned beef, which of course is a universal procedure on the part of canners of these products.

The index is somewhat inadequate, and a somewhat fuller bibliography might have been expected.

However, the book is one that should figure on the bookshelves of all canners of fruits, vegetables and meats.

T. C.-W.

Campbell's Book, Canning, Preserving, Pickling. By Clyde H. Campbell. New York. 1937. *Pp.* 848.

Appetising, or the Art of Canning. By A. W. Bitting, M.D. San Francisco. 1937. *Pp.* 852. *Illustrated.* 31*s.* 6*d.*

Biochemistry Applied to Malting and Brewing

Brewing is one of the most important of British industries. The contributions it has made to the subject of biochemistry during the latter's rapid advance in the last two decades have been of no mean order. Yet the striking fact remains that there is a signal lack of textbooks in English dealing systematically with the scientific principles underlying the actual processes of malting and brewing. What has long been required is a book which dealt with the applications of modern biochemistry to the fermentation industries. The book at present under review is an attempt to remedy this state of affairs.

As its collaborators we have that happy combination of the trained scientist and the practising brewer. The fact that they are respectively the Professor of Brewing and Industrial Fermentation in the University of Birmingham and the Head Chemist of the famous Tuborg Breweries, Copenhagen, who is also Lecturer at the Scandinavian Brewing High School in the city, invests the book with the necessary air of authority.

The work is really a substantially enlarged English edition and, in parts, a translation of B. Krause's *Laerebog i Maltningens og Brygningens Teori* (Copenhagen, 1935). Making the justifiable assumption throughout that the reader possesses some knowledge of the general laws of physics and chemistry, the authors have planned the book in five chapters which fall into two broad divisions.

The first of these, embracing Chapters I and II, is devoted to a consideration of those aspects of general physics and chemistry most essential for an understanding of biochemistry. For many readers the study of this section of the book will be of the nature of revision, but they have been included, quite rightly we believe, for the purpose of helping the older reader who has not been able, for one reason or other, to keep pace with the rapid advances of biochemistry of recent times. The first of these chapters is given to a discussion of such subjects (to name a few) as electrolytic dissociation, hydrogen-ion concentration and *p*H, amphoteric electrolytes, oxidation

and reduction, and colloidal state; the second to the general chemistry of the brewer's raw materials—*e.g.*, carbohydrates, fats, proteins, tannins, enzymes and vitamins. At the end of this section is added a list of textbooks, confined chiefly to those fields in which recent advances have been greatest, for those readers who wish to pursue their reading further.

The third, fourth and fifth chapters, covering some 200 pages and constituting the main portion of the book, deal respectively with the applications of modern biochemistry to the technology of malting, brewing and fermentation. Herein are treated such themes as the chemical composition and valuation of barley; its drying, storage and steepage; the influence of various factors on the germination processes; the composition, analysis and valuation of malt. The authors then pass on to a consideration of the factors influencing the quantity and quality of the extract from the mashing process, the treatment of the wort, etc., the final chapter being devoted to the problems concerning fermentation and the finished beer. Here are discussed the constituents of yeast, the chemical mechanism of alcoholic fermentation, the metabolism of yeast, the influence of the medium on yeast growth and fermentation, the conditioning, filtration, pasteurisation and the stability of beer. In their treatment of this part of their work the authors have aimed, firstly, at indicating the influence of extraneous conditions on the process under study, and, secondly, at showing the practical maltster or brewer what conclusions may be drawn from the analytical data regarding the barley, hops, wort, etc., used. In many of these fields where no final conclusions can be strictly drawn, the writers have not hesitated to produce evidence supporting a particular opinion or suggesting a definite procedure. In so doing, they have made free use of analytical data from the laboratory records of the Tuborg Breweries and from scientific journals.

In general the subject matter has been well selected and its arrangement is attractive. At the same time it would scarcely do the book justice if one did not draw attention to some of its shortcomings. For example, γH is mentioned (page 30) fully a page before it is defined; the biuret reaction for the detection of protein is described but no mention is made as to the manner in which the groups responsible for the reaction arise. It is, moreover, to be regretted that the value of the book should be marred by the low standard of English throughout. Otherwise, it is an excellent book and it will, we feel sure, find a ready sale not only among students, technicians and chemists in the fermentation and allied industries but also among biochemists generally.

W. R.

Biochemistry applied to Malting and Brewing. By R. H. Hopkins and C. B. Krause. London. 1937. *Pp.* 342, *with* 6 *appendices.* 12*s.* 6*d.*

Human Affairs

As is evidenced by the interest accorded the grouped opinions of leading men of science published in these columns during the past three months, scientists are beginning actively to clamour for their rightful place at the controls of human affairs. This book is a demand by fifteen leading men of biology, psychology, and philosophy for the scientific control of world affairs. The three editors responsible for this new type of book are professional psychologists, and they claim their work to be the 1937 manifesto to Scientific Humanism. A monthly periodical entitled *Human Affairs* is planned, and the present work is an attempt to measure the extent of public support and pave the way for this projected journal.

The contributors to this book are well known and each a leader in his own field. Their opinions, even if one does not wholly agree with them all, cannot be disregarded and provide stimulating and provocative food for thought and discussion. It is eminently a book for scientists and for those intelligent men and women who realise that as time proceeds the necessity for deliberate conscious control of human affairs becomes greater and greater.

J. P. L.

Human Affairs. Fifteen Contributions edited by R. B. Cattell, J. Cohen, and R. M. W. Travers. Pp. 360. *London.* 1937. 10*s.* 6*d.*

Pasteur

The name of PASTEUR is a household word in the civilised world, and the impact of his researches affects even those parts of the world not yet civilised. This is not a new book—it first appeared (in two volumes) in 1901, and has been reprinted in one volume every few years, last appearing in 1928. This new printing arrives at a time when it is, perhaps, more than ever necessary to remind both chemist and layman of the beauty and power of science. The book is both fascinating and inspiring. It contains an introduction by Sir William Osler, Bt., M.D., F.R.S., who, of Pasteur, quotes a writer: "that he was the most perfect man who has ever entered the Kingdom of Science."

L. A.

The Life of Pasteur. By René Vallery-Rodot. With an introduction by Sir William Osler, Bt., M.D., F.R.S. Pp. 484. *London.* 1937. 7*s.* 6*d.*

The Romance of Medicine

Primarily intended for young people of fifteen to nineteen years of age, this book, as is so often the case, makes fascinating reading for any whose knowledge of medicine is limited to one particular aspect. Covering the conditions existing in the old pre-scientific days, the contrast with the modern scientific eras of medicine are clearly and dramatically pictured. The discoveries of great men such as Jenner, Pasteur, Lister, and Simpson, and the advancement of biochemistry, bacteriology, and physics are outlined and discussed with an absence of technical terms.

The present writer cannot agree with DR. HAYWARD'S contention on page 186, concerning canned foods, "that it would be a good thing for the nation to become less 'tin-minded'". It is indeed astonishing how hard dies the prejudice against canned foodstuffs, which, on the whole, are more carefully prepared than most 'fresh' foodstuffs. Beyond this criticism one can have only the highest praise for this interesting work.

J. P. L.

The Romance of Medicine. By John Hayward, M.D. London. 1937. *Pp.* 278. *Illustrated.* 6*s.*

Byron and Food

The Editor.

SIR,

With reference to "Candid Shots" in the current number of FOOD MANUFACTURE, I would joyously inform you that Byron's objections to women "gobbling food" in public were scarcely based on æsthetic grounds. He confessed to a friend that the "wretched creatures" were always served first and consequently got all the best bits. So much for romance.

A charming description of a woman "eating her food archly" is found in a recent thriller, *Murder in Government House.* The vamp feeds prettily, with much play of flashing bangles and delightful hands. I trust that I have got the quotation right, but it is on about the third page and can be easily rectified.

Yours, etc.,
OLGA HASTINGS BONORA.

GLAXO LABORATORIES, LTD.,
GREENFORD.

EDITOR'S NOTE.—*We should be devastated at the way in which our correspondent has debunked the little bit of romance about Byron had not we the idea that what the poet said to his friend was only one of his "little ways". Look at the way he went on about the recently introduced waltz!*

As regards the quotation from Murder in Government House, *we do not quite know what this is intended to prove. The author could hardly claim priority, Brillat Savarin having died about* 1826.

VITAMIN D— SYNTHETIC *v.* NATURAL

We published in the November issue a note on "A New Vitamin Product", and have received from Mr. A. L. Bacharach a communication, in which he enclosed a reprint of a paper read by him before the British Association Meeting in Nottingham in September, 1937. Mr. Bacharach objects to the statement that "irradiated ergosterol (calciferol) . . . is not as efficacious to the human organism as is vitamin D made from fish liver (natural vitamin D)".

MR. BACHARACH said in his paper:

"One still occasionally encounters in the literature statements such as that 'natural vitamin D is more active than the artificial product'. These are mainly revealing in so far as they point to a subconscious primitive nature-worship in those who make them, but it is still permissible to consider for a moment what can be meant by such statements. When they were first made, natural vitamin D had never been isolated. Its activity, therefore, in any biologically determined unit, could not be expressed as the number of those units in a gram of vitamin. On the other hand, the so-called artificial vitamin D, vitamin D_2 or calciferol, was available as a pure crystalline compound, with known physical and chemical constants. This substance, when assayed against the International Standard Preparation of vitamin D, itself a solution of crude unisolated calciferol, was found to contain 40 million international units per gram. In what possible sense could it be said that this was more, or less, active than 'natural' vitamin D, which had never been isolated?

The observations on which this meaningless statement was based are simple, and are generally accepted. If a sample of cod liver oil, or other source of 'natural' vitamin D, is standardised on rats in comparison with the International Standard Preparation, its activity can be expressed as a certain number of international units per gram. (As we now know, the two active substances are chemically somewhat different; vitamin D_2, to give it its present name, is being compared for its activity on rats with crude calciferol in irradiated ergosterol.) It can then be established that a given number of units of vitamin D in the cod liver oil are far more effective in curing or preventing leg weakness in chickens than the same number of units in the International Standard Preparation or some other preparation of calciferol.

The fact that the rat has been used as assay animal was alone responsible for the statement that artificial vitamin D is less active *for the chicken* than the natural form. Had the chicken been the assay animal used, it would with equal accuracy have been said that artificial vitamin D is much more active on the rat than the natural vitamin D. Both statements would be equally true in the form in which I have expressed them, but there is no justification for the statement that natural (or synthetic) vitamin D is more active than synthetic (or natural) vitamin D, without specific reference to the *pair* of species on which the comparisons have been made.

Actually, of course, we know to-day that the 'natural' vitamin of tunny and halibut liver oils, identical with the antirachitic irradiation product of 7-dehydrocholesterol, contains 40 million international units per gram, when compared on rats with the International Standard Preparation. It has, therefore, on a rat basis, the same activity as calciferol. Moreover, the work of Eliot and her colleagues affords strong evidence for believing that both forms of vitamin are equally effective in the prophylactic treatment of human rickets at ordinary levels of dosage. The work of Lewis, though carried out on too few animals to permit statistical analysis or to justify a final conclusion, does suggest a slight difference for the human being in favour of vitamin D_2, when curative treatment is being undertaken. It is unlikely that the ratio of effectiveness is as great as 2 : 1, and, in view of the large error involved in assessing the extent and cure of human rickets, the difference between the two forms of vitamin must be regarded as of doubtful practical significance, even if Lewis's results are confirmed. Only if they are confirmed, however, would it be true to say that for the human being one form of vitamin D has been proved to be more active than another, and the statement would even then only be justifiable provided both forms of vitamin have been isolated in the pure crystalline form, so that a comparison on a weight for weight basis is possible."

In further writings, Mr. Bacharach has mentioned that "equal numbers of units of calciferol and vitamin D_2 are equally effective on the human being" and that "according to the 1936 Addendum of the British Pharmacopœia the prophylactic doses of calciferol expressed in international units D are much larger than corresponding doses contained in cod liver oil, as also expressed in international units D".

DR. ING. EMIL COLLETT, of Oslo, to whom the above was submitted, has written as follows:

"Your correspondent refers to various publications of which he is the author and an address given by himself recently, in which he claims to prove that the antirachitic effect of artificial vitamin D—calciferol—is better, or at least as good as, that of natural vitamin D. In our opinion, however, there is a good deal of evidence against this contention.

Your correspondent says that 1 gram of calciferol has a greater antirachitic effect than 1 gram of natural vitamin D. This may be so, but it is not the point. What is important is the relative effect of one international unit vitamin D in the form of calciferol compared to one international unit in the form of natural vitamin D as contained in cod or other fish liver oil, because natural vitamin D is never sold by the weight of the chemically pure vitamin, but according to the number of international units it contains. The same probably also applies to calciferol. To the physician and public it is of no interest to know how many grams of vitamin D there are in a product. What they are concerned with is its antirachitic value.

Your correspondent claims that 'equal numbers of units of calciferol and vitamin D_2 are equally effective on the human being', but we maintain that this claim is not justified. (We presume D_2 to be natural vitamin D.) It is based on certain observations made by Eliot, but these observations are apparently not made on a comparison of *oils* containing on the one hand synthetic vitamin D and on the other hand natural vitamin D, but seem to be based on samples of *milk* which have been vitaminised by means of calciferol, by irradiation, by adding irradiated yeast to the cow's feed or by means of cod liver oil. There is a great deal of evidence to show that other authorities share Eliot's opinion regarding the greater effect of vitamin D in the form of vitamin D milk, but they have also proved that milk vitaminised in different ways does not have the same efficiency. They further have proved that oils containing synthetic vitamin D are far less effective in preventing and curing rickets than natural vitamin D. For example, Hess, who is a first-class authority in these matters (*Acta paediat.*, 1933, **16**, 467-473), refers to the observation that infants require a greater number of units of irradiated ergosterol than of cod liver oil to give protection against rickets. Again Hess, Lewis and Rivkin (*J. Amer. Med Assoc.*, 1930, **94**, 1885) describe the study of sixty infants from four to twelve months old and remark that rapid healing was produced by approximately 2,100 units

of cod liver oil in an infant in whom rickets developed while he was receiving approximately 5,700 units in the form of 'Viosterol'.

Space is not available to permit us to quote details of this evidence. We can therefore only give references, but shall be glad to supplement them with details if required.

1. A. F. Hess and J. M. Lewis, *J. Amer. Med. Assoc.*, 1933, **101**, 181-184.
2. A. F. Hess, *Acta paediat.*, 1933, **16**, 467-473.
3. Barnes, Brady and James, Cod Liver Oil—Ergosterol, *Amer. J. Dis. Child*, Jan., 1930, **39**, 45.
4. De Sanctis and Craig, Cod Liver Oil—Ergosterol, *J. Amer. Med. Assoc.*, 1930, **94**, 1285.
5. Hess, Lewis and Rivkin, *J. Amer. Med. Assoc.*, 1930, **94**, 1885.
6. Campere, Porter and Roberts, *Amer. J. Dis. Child*, 1935, **50**, 55.

Your correspondent also has stated that, according to the 1936 Addendum to the British Pharmocopœia, the prophylactic doses of calciferol expressed in international units D are much larger than corresponding doses contained in cod liver oil, and also expressed in international units D, which means that an international unit D in cod liver oil is much more effective than such a unit in an oil containing calciferol."

Dr. Lampitt finds *B. coli* in Food Colours

ARE dyestuff manufacturers careless of contamination? This is the question raised by the well-known research director of Messrs. J. Lyons and Co., Ltd., when, at a meeting of the London Section of the Society of Dyers and Colourists, at which he lectured recently, he made the grave statement that he had found bacteria, principally *Bacillus coli*, in samples of food colouring matters examined in his laboratories.

So great was the concentration found that the department of the famous catering house had to condemn many consignments, as methods of sterilisation in use were found to be unavailing in many instances.

These statements were received with amazement by the dyestuff manufacturers present, who severally averred that they had never had a complaint of this nature. They had to admit, however, that they had no definite knowledge to the contrary, and some announced their intention of examining their products without delay in order to eliminate this possible source of infection.

As Dr. Lampitt pointed out, the danger lies not in the few large manufacturing and distributing houses which possess the means of testing, but in the innumerable smaller factories which have no laboratories nor facilities for controlling an unsuspected menace to the purity of their products.

Prevention of Chocolate Bloom

THE greying of chocolate on storage, the so-called fat bloom, is a major problem of the chocolate industry, and all chocolate manufacturers will read with great interest the first part of a "Physico-Chemical Investigation Incidental to the Study of Chocolate Fat Bloom," by Dr. William Clayton and his collaborators, which has recently appeared in the *Journal of the Society of Industry*, especially as the results obtained in this investigation already promise an easy solution to what is, indeed, a very grave problem. Whymper's experiments have demonstrated that the crystals constituting the bloom are composed of the higher melting fractions of cacao butter. Constant thermal conditions throughout the preparation and shelf-life of chocolate being impossible, there is always a danger of fractional crystallisation of higher melting glycerides from lower melting ones taking place, which, however, may be minimised by mechanical treatment during preparation. Prolonged agitation of plain chocolate in the conche, the temperature rising to 40-50°, is definitely beneficial. Is this due purely to physical conditions, or to chemical changes? Partial oxidation of the fat is a possibility, the consideration of which led to the authors' investigating the properties of oxidised cacao butter.

Although the addition of lecithin to chocolate greatly increases fluidity, the action of this substance so far as preventing the development of bloom is concerned, though beneficial, is trifling. Lecithin is hydrophilic. Both hydrophilic and hydrophobic types of particles (sugar and fat) occur in chocolate. Those that are responsible for bloom belong to the hydrophobic class.

The authors find that oxidised cacao butter possesses marked capacity to inhibit (*a*) fat bloom in chocolate, and (*b*) an allied phenomenon, the deposition of stearin from chilled olive oil. Oxidation is effected by blowing with air cacao butter at 250° C., until the iodine value has fallen from an initial value of about 36 to 19·5 to 22·5. Two types of the oxidised fat have been prepared, one chocolate in colour, the other pale yellow. There is possibly some difference in the polymerisation; and the dark-coloured product is the more effective. The incorporation of this new material offers a simple solution to the fat bloom problem; but it should be noted that, in the case of chocolates with nut centres, complete immunity is not given. This type of fancy chocolate presents a problem of special difficulty.

The authors state that they believe that oxidised cacao butter has a definite balance between hydrophilic and hydrophobic molecular groupings which lead to adsorption-orientation phenomena with results of remarkable academic and technical interest. They hope to demonstrate that the blown fat is more polar than the original fat by the technique of Holmes and Thor. This matter and other technical questions and results will be dealt with in Part 2 of the paper, the publication of which, we are sure, will be awaited with considerable interest.

Butter in Canada

THE consumption of butter in Canada during 1936 was 346,553,280 lb., or about 31½ lb. *per capita*.

GENERALITIES

New Margarine Works

N. V. Benninga's Friesche Margarine-fabrieken, a Dutch company, is, it is understood, initiating a project for margarine production at Hull. £200,000 is the cost of equipping the new factory, its object being the refining of raw materials for margarine production.

* * *

Oxo Advertising

Mr. H. C. E. Hart, of Oxo, Ltd., has been appointed to control the company's Press advertising in succession to the late Mr. Frank Hackett.

* * *

J. and E. Hall, Ltd.

The "Sirocco" air-conditioning plant at Courage and Co.'s brewery, which we illustrated on page 426 of our last issue, was supplied to J. and E. Hall, Ltd., who were the main contractors on this job.

* * *

New Government Analysts

The Minister of Health, Sir Kingsley Wood, has approved the following appointments: Harold Edward Monk as a public analyst for the borough of Kidderminster, in place of C. C. Duncan, now retired; Rhys Pendrill Charles as a public analyst for the borough of Penzance, in place of W. Partridge (deceased) and in addition to C. G. Moor; Frederick Grant Duncan Chalmers as a public analyst for the borough of West Bromwich, in place of Harry Sylvester, now resigned.

* * *

Industry Moves Northwards

An interesting development in the refrigeration world has taken place in the decision of L. Sterne and Co., Ltd., the Glasgow firm of refrigerating engineers, to transfer to Glasgow the business of the Haslam Foundry and Engineering Co., Ltd., of Derby, of which firm they acquired the control some three years ago.

Both firms have been engaged in the design and manufacture of refrigerating plant for over half a century, in fact, ever since the discovery of the principles of mechanical refrigeration, and the consolidation of the interests of these old-established concerns in Glasgow under one control is an event of major importance in the engineering world.

Food and Clothes from Timber

A Christmas season exhibition, opened recently by Lord Kennet at the Science Museum, South Kensington, shows the public many astonishing results of timber research in recent years.

"Through the by-products of the forest we have a new bulwark of defence and an assured mitigation of the evils of blockade," a research worker said. "We can go to our trees for the manufacture of cloth. By using wood, 40 per cent. of cotton in cotton goods can be saved, and by a mixture of wool and timber fibres 40 per cent. of wool can be saved.

"Cattle cake, wood sugar, artificial silk, wood alcohol, wood flour with its many uses, and even sausage skins can now be manufactured from trees. Not long ago an experimental supply of face powder was produced from wood flour, and received the high commendation of the wife of the experimenter, who used it without knowing its source."

Sir Roy Robinson, Chairman of the Forestry Commission, presided at the opening of the exhibition.

* * *

Mr. Robert Kellie

It is with great regret that we record the death, on December 7, of Mr. Robert Kellie, head of the house of Robert Kellie and Son, Ltd., the well-known coppersmiths and food manufacturers.

Mr. Kellie had been unwell for a few weeks, and seemed to be mending slowly, when the end came suddenly after a severe heart attack.

We tender to the bereaved family our sincerest condolences.

Refrigerating Plant at Claridges

In conjunction with the extensive air-conditioning plant to be installed at Claridges Hotel, H. J. West and Co., Ltd., have received the contract for supplying the refrigerating plant. This will comprise two vertical, twin-cylinder, single-acting ammonia compressors of the "Polar" sleeve valve type, each force-lubricated throughout and operating at 360 and 485 r.p.m. respectively. They are directly coupled through a flexible coupling to 60 and 85 h.p. slip-ring motors, and each compressor is provided with its own multi-tubular, counter-current ammonia condenser and water cooler. A centrifugal pump will circulate cooling water from each condenser through its own forced draught cooling tower, so conserving the condenser cooling water. Special features of this installation are the silent valveless type compressors, and super-silent electric motors, which combine to give absolute quietness in operation. Excess refrigeration will be ingeniously utilised to produce cooler running conditions for the compressor so that full speed is possible, without the danger of freezing the water in the evaporator.

* * *

Blood Poisoning

Sepsis is a common problem of industry which can be extremely costly both to employers and employees. Preventive measures are easy to devise—they are summed up in the rule "Prompt First-Aid treatment for *all* wounds"—but are not quite so easy to enforce. Employees are apt to think that a small cut or puncture wound cannot possibly be dangerous, they fail to report for treatment, sepsis results, and an injury which could have been dealt with in a few minutes ends by keeping the man away from work for a matter of days or even weeks.

Acting on the principle that the first step in getting a rule obeyed is to make the reasons for it understood, the National Safety-First Association has issued a four-page leaflet for distribution to employees. The leaflet explains in a brief, clear, and interesting manner exactly what happens when germs invade a wound and shows plainly and unmistakably why first-aid treatment is necessary in all cases.

The price of the leaflet is 1s. 10d. per 100, plus postage. Specimen copies will be supplied free by the Association on request.

700 Years' Old Fair

The present day size and importance of the Leipzig Fair is a direct result of its 700 years' history. When first formed, the Fair could give what other forms of trading could not—namely, the facilities for personal contact between the buyer and seller in the form of an array of goods or samples. This personal contact not only hastened the closing of deals, the clarifying of conditions of delivery, and, what is now so very important, exchange and tariff questions, but also emphasised the innumerable innovations for which the Fair is famous. These advantages prevail to-day and are probably the reason for Leipzig's continued success.

The 1938 Fair will be held from March 6 to 14, and will represent more than 20 countries comprising 9,000 exhibitors. Since 1933 the number of exhibitors has increased by 40 per cent. and the number of foreign exhibitors by 50 per cent.

* * *

Growth of Food Plant Manufacturers

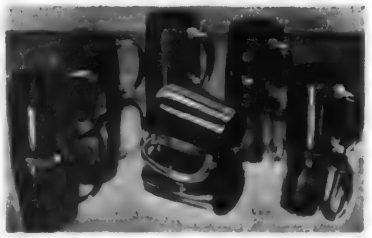
The revival of trade is reflected in the fact that the food plant department of John Thompson (Dudley), Ltd., is growing in volume of output year by year, especially in the manufacture of their streamline, jacketed boiling pans, constructed in stainless steel, monel, and nickel. Their vertical and horizontal canning retorts which embody the latest principles of manufacture and also of scientific sterilisation have been well received in the trade, and a batch of vertical retorts, capable of canning 6 tons per day of hams, were started up at the end of September. The retorts are also used extensively in the fruit canning trade. Erection work in connection with plant is also a speciality of the company. The Food Technical Department of John Thompson (Dudley), Ltd., is always available for consultation.

* * *

Fruit, Vegetables, Sea Foods

The practice of quick-freezing fruit and vegetables continues to expand in America. This year several large packers have operated the process on the strawberry crop with conspicuous success. One firm freezes the strawberries in a syrup containing honey; four tons of honey were used during June.

In Texas sea-foods such as oysters, shrimps, crabs, and fillets of fish are being quick-frozen and sold hundreds of miles away as "fresh frozen" foods.



Shining with the immaculate gleam of stainless steel, these tankards made by Edgar Allen and Co., Ltd., are only one of the traditions of England which are being replaced by modern invention. Pewter yesterday, but stainless steel to-day! And so the change goes on.

Mass Experiments Planned

The Bread Consumption Committee of the American Society of Bakery Engineers is studying the effects of sponge and dough temperatures on bread quality. Experiments in baking laboratories have been completed and now the Committee is turning to the baking industry to try out the experiments on a large scale. All members of the Society employed by bakers have received a letter inviting them to carry out certain experiments if they so desire.

* * *

Half-a-century Completed

Mr. Henry Lloyd Wilson joined the staff of John and E. Sturge, Ltd., 50 years ago, and since then he has been in continuous charge either as Senior Partner or as Chairman of the Board. On December 8 a presentation was made by the staff and workpeople of the company, and we too would extend our congratulations to Mr. Wilson.

* * *

New Depôt at Docks

New premises, to be used as a distributive depôt for the South Coast, Isle of Wight, and Channel Islands, are being built by H. J. Heinz and Co., Ltd., on land reclaimed by the Southern Railway Co., in connection with Southampton's dock extension scheme.

Heinz and Co. have for some time past been using a temporary site at the Inner Dock for distribution purposes, but the premises on the new dock estate will be better suited to their requirements. They will consist of a large warehouse on the ground floor, with offices overhead, and the building will occupy an area of approximately 15,000 square feet. The site selected is adjacent to the Solent Flour Mills.

* * *

Telegraphic Change

The telegraphic address of Messrs. Carty and Son, Ltd., has been changed to "Vatmakers Phone London".

Changes of Address

C. C. Gibson have moved their offices to 39, Warren Street, Fitzroy Square, London, W. 1. Telephone Museum 5072.

* * *

The head office of Mono Pumps, Ltd., has been moved to a more central point at Clifton House, Euston Road, N.W. 1, telephone number, Euston 5432.

* * *

Owing to the growth of the business of Kork-N-Seal, Ltd., on and after January 10 their offices will be at new and larger premises at 8, Leicester Street, London, W.C. 2. Telephone Gerrard 8611 (10 lines).

* * *

Providing for the Future

The problem of old age and of the retirement of employees who are no longer able to "pull their weight" is one which all employers of labour must from time to time have to face. In any form of industry there is almost always need of some form of Provident Scheme or Pension Fund for employees, preferably a scheme assisted in some measure by the employer.

Many small firms and companies cannot afford to institute a complete and elaborate pension fund, and the Provident Scheme put forward by the National Savings Committee should have a particular appeal in such cases, although it is equally applicable to large and small businesses. The scheme is already operating in upwards of 450 places of employment and more than 20,000 employees are regular contributors. The National Savings Provident Scheme is flexible and easily adaptable to the requirements of individual factories and shops.

Besides the Provident Scheme outlined above, the National Savings Committee offers a number of other schemes for saving for long or short periods. Full particulars of any of the schemes may be obtained on application to the National Savings Committee, Sanctuary Buildings, Westminster, S.W. 1, or, in the case of Scotland, to the Scottish Savings Committee, 35, Manor Place, Edinburgh, 3. Communications may be sent "O.H.M.S." without prepayment of postage.

* * *

Now with Apex

Mr. F. W. Lloyd, of Ipswich, who has had many years' experience of heat problems with well-known firms, has been appointed Eastern and North-Eastern Counties representative for Apex Construction, Ltd.

INFORMATION and ADVICE

Growing Food without Soil—Chemical Preservatives—Packed Beetroot in Red Currant Jelly—Tomato Purée—Beetroot in Malt Vinegar—Fish Pastes and Fish Cakes—Vitamins

Growing Food without Soil

3,202. *Particulars required as to exact composition of basic mixture of salts, with the concentration of the solution made therefrom, for growing flowers and vegetables in water. Production of many foods by this method has been most successful in America; several articles dealing with generalities, but details lacking. Latter desired, to commence small-scale experiments.* (Dublin.)

We regret to say that despite considerable enquiry at the Ministry of Agriculture and other sources we are not able to obtain any information. As you say, we have seen several articles dealing with generalities, but no details. Perhaps some of our readers might assist?

Chemical Preservatives

3,196. *I shall be very much obliged to you if you would kindly let me have the addresses of manufacturers of chemical preservatives used by the food industry. Is it allowed to add chemical preservatives, as benzoic acid, to canned fruit products in England?* (Hanover.)

The food regulations in this country allow the use of only two preservatives—benzoic acid and sulphur dioxide—besides other substances like sugars, common salt, vinegar, alcohol, saltpetre, and spices.

No chemical preservatives are added to canned fruit. The process of sterilisation, if properly carried out, is sufficient to prevent decomposition. Fruit pulp preserved with sulphur dioxide should not be used for canning. A trace of sulphur causes the formation of hydrogen sulphide in the can and gives the pack an unpleasant flavour and a poor appearance.

Three names of firms supplying chemical preservatives were given.

Packed Beetroot in Red Currant Jelly

3,177. *In* FOOD MANUFACTURE *of February, 1936, in your reply in the "Information and Advice" page to Enquiry No. 1,975 you mentioned packed beetroot in red currant jelly.*

We should be glad if you would kindly oblige us with a recipe for the manufacture of this. (Darwen.)

If you are making your red currant jelly from fresh fruit you would take 50 lbs. of red currants, 6 gallons of cold water, and gently bring to the boil and simmer for 30 minutes. Then put it into a jelly bag and let it drain overnight. Next day 50 lbs. of sugar are added to the juice, after having brought the juice to the boil. Bring to the boil again, let stand, and pass through a filter bag until quite bright. To facilitate peeling, the beets are usually steamed in a retort for about 20 minutes at a temperature of about 220° F. After peeling, the beets are placed in cold water, but not left there too long. They are cut into slices, and the slices packed into glasses or tins end on. Boil up the jelly to 220° F. and pour as hot as possible over the beetroot in the containers. Having been closed the containers are processed at 240° F. for 40 minutes. If tin containers are used they should be lacquered on the inside.

You will understand, of course, that this is quite a tentative recipe and may require to be modified.

Tomato Purée

3,235. *Please supply me with the following information.*

(a) *Figures showing the quantities of tomato purée, paste, and pulp imported monthly into the United Kingdom during the years* 1933-1937. (b) *Particulars of standard packing.* (c) *An indication of present prices for the various concentrations.* (d) *Approximate quantities of purée of given concentrations derived from a given weight of raw fruit.* (e) *Recommended times and pressures for exhausting and sterilising.* (f) *Bibliography on the subject of tomato cultivation and production of canned purée.* (Vizagapatam.)

(*a*) Figures were given for the years 1935-1937. (*b*) The standard packing for the wholesale trade is the 5-kilo can. (*c*) The prevailing prices of the different concentrations were given. (*d*) The average analysis of tomatoes is 92 per cent. water and 8 per cent. solids (approx.). The concentrations given are percentage solids in the purée or paste. A simple calculation will give you the weight of fruit required to produce a given quantity of purée of given concentration. (*e*) We cannot recommend any definite times and pressures for exhausting and sterilising, as these vary according to concentration of purée and the size of the can. (*f*) The following books should be useful: *Commercial Tomato Culture, Tomato Cultivation, Diseases, and Pests, Tomato Growing for Profit,* and *Campbell's Book, Canning, Preserving, Pickling.*

Beetroot in Malt Vinegar

3,324. *What would you suggest in order to keep in good condition for 6 months or more beetroot in malt vinegar?* (Yorks.)

Beetroots should be pickled first in casks in a 6¼ per cent. solution of acetic acid for 48 hours before filling into jars, and then enough 16-grain pale malt vinegar is put in the jars to cover up the beets well. Under these conditions they will keep for some time.

Fish Paste and Fish Cakes

3,347. *We are contemplating manufacturing general fish paste products and would like you to furnish us with recipes covering same, or inform us where these recipes may be obtained. Could you give us a recipe for making fish cakes as supplied to leading caterers, also method of manufacture?* (London.)

Fish cakes. Proportions: ½ lb. cooked fish, ½ lb. potatoes, 1 oz. butter, yolk of egg, salt and pinch of cayenne pepper, anchovy essence. Put the potatoes through a sieve, break the fish up very small. Put the butter and milk in a steam jacket pan; when hot add the potatoes and fish, mix in the yolk of egg, salt and pepper.

Make the mixture into balls, one tablespoonful each, flatten them into cakes, brush over with egg, cover with breadcrumbs, and fry in fat. The mixture may be made into a fish pudding by greasing a flat tin, shape the mixture as desired, brush over with egg and bake for quarter of an hour.

Fish pastes. The choice of ingredients is a matter which is largely governed by consideration of price and type of market. It rests with yourselves to develop your own recipes. Here are two suggestions:

Salmon and shrimp paste:

Salmon	50 lb.
Bacon fat	12 ,,
Shrimps (skinned)	10 ,,

Flavour with sugar, cayenne, white pepper and ground mace.

Bloater paste:

Bloaters	24 lb.
Bacon fat	16 ,,
Salmon	12 ,,
Anchovies	12 ,,
Rice flour	4 ,,

Add butter for high-class product and flavour with pepper and nutmeg.

Ingredients are minced and mixed well. The pots are filled to the top to exclude air; caps are rolled on and the jars sterilised at 230° to 240° F. for 30 to 40 minutes in case of 3-oz. jars and longer for larger jars.

Vitamins

3,344. *We are interested in the preservation of the vitamin C content of citrus concentrates and tomato concentrate. We are using analytical and biological methods of determining this vitamin, and would appreciate information as to what other people have found in similar concentrates.*

The citrus juices are preserved with sulphur dioxide (5-6 grains per pint). Would this have any effect, deleterious or otherwise, on the conservation of vitamin C?

Can you give us any information regarding the presence of other vitamins in these products, and their stability to the concentration process and storage?

Concentration is carried out in glass-lined stills, at a vacuum of 26 lb., and a temperature of 140° to 150° F. for tomato, and 120° to 130° F. for citrus juices. (Australia.)

Action of sulphur dioxide on vitamins. Davey (*Biochemical Journal*, 15, **83**, 1921) showed that the antiscorbutic vitamins of lemon juice were preserved at temperatures near freezing point by 0·06 per cent. (or 600 parts per million) of potassium metabisulphite. But at higher temperatures a destruction of the vitamin occurred. It was found later (Delf in *Biochemical Journal*, 19, **141**, 1925) that 5/6 of the antiscorbutic potency of lemon juice was lost after 4½ years' storage when 0·06 per cent. of potassium metabisulphite was present. Williams and Corran (*Biochemical Journal*, 24, **37**, 1930) conclude that potassium metabisulphate is the best (of several, including sodium benzoate) preservative for lemon juice against fermentation, but that it has a deleterious effect on the vitamin C content at ordinary room temperature.

Vitamins in tomato concentrates. Kohman, Eddy and Zall (*Industrial Engineering Chemistry*, 1930, p. 1015) found that oxidation is particularly destructive of vitamin C—*i.e.*, when air is in intimate contact with juice during preparation. Vitamin A is stable under usual process conditions, but is removed by filtration. Vitamin B is affected if conditions favouring oxidation obtain. Vitamin C potency was maintained during regular canning methods and concentration in open kettles to ⅔ volume on greater concentration *in vacuo* does not influence the vitamin C. Preliminary admission of air must, however, be avoided. Steam appears to have a protective influence on vitamin potency.

In FOOD MANUFACTURE, February, 1929, we published abstracts of two articles from *Biochemical Journal*, 1928, Vol. 22, pp. 535-542, and *Perfumery and Essential Oil Record*, July, 1928, pp. 261-262, dealing with the vitamins of commercially concentrated orange juice.

Citrus concentrates. Cruess in FOOD MANUFACTURE, December, 1932, says it is essential that a very high vacuum be maintained during concentration in order to maintain a low temperature, preferably below 120° F., in juice undergoing concentration.

Professor Sherman of Columbia University gives the following comparisons:

Orange juice. Vitamin A 350, vitamin B 150 (approx.), vitamin C 150-300.

Tomatoes, raw or canned. Vitamin A 2,700, vitamin B 130-250, vitamin C 150-300.

Materials and Equipment Required

We have received enquiries concerning the supplies of the following equipment and materials, and suitable recommendations have been made:

3,354. *Reader interested in a complete line for cube bouillon manufacturing.* (Stockholm.)

3,317. *Best method of vacuum sealing of canned ham. Which system is to be preferred?—the vacuum double-seaming machine or the vacuum tin-sealing machine, where the tins are sealed in a vacuumised chamber. Also makers of these machines.* (Göteborg.)

3,336. *Manufacturers of sterilising plants suitable for pastes and powders.* (Burton-on-Trent.)

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TRADE MARKS

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal", and is published by permission of the Controller of H.M. Stationery Office. The "Trade Marks Journal" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

BAKEXA.—579,411. **Edible oils, edible fats, and oils and fats for use in cooking.** MERSEYSIDE FOOD PRODUCTS, LTD., 51, North John Street, Liverpool. November 24.

BIRCH TREE.—579,656. **Margarine, lard (for food), and lard substitutes (for food).** CAMPBELL, JONES AND COMPANY, LTD., 1, Watergate, Tudor Street, London, E.C. 4. November 24. (Associated.) (By Consent.)

Registrations Nos. 247,817 (1280), 368,407 (1954), 374,458 (2019) will be cancelled if and before the applicants' mark is registered.

BLINTRADA.—581,178. **Substances used as food or as ingredients in food.** FREDERICK JOHN MULLEY, 65, Brentham Way, Ealing, London, W. 5. December 8.

CAFOMILL.—579,551. **Coffee essence and essence of coffee and chicory.** PEEK BROS. AND WINCH, LTD., 20, Eastcheap, London, E.C. 3. December 1.

CALF BRAND. — 579,041. **Condensed**

milk. CONDENSED MILK COMPANY OF IRELAND (1928), LTD., Lansdowne, Limerick, Irish Free State. December 1.

DIAMELE.—578,563. **Substances used as food or as ingredients in food, all consisting of or containing meal.** H. A. AND D. TAYLOR, LTD., The Maltings, Sawbridgeworth, Hertfordshire. December 1. (Associated.)

EARLY MORN.—579,091. **Canned fish, canned meat, canned fruit, and canned vegetables.** R. J. BROWN AND SONS, LTD., London House, Meadow Lane, Nottingham. December 1.

FORTA. — 579,543. **Yeast.** JAMES P. SHERWOOD, LTD., 60, Wellington Street, Leeds, 1. December 8.

GOLDEN PUFTIES.—578,470. **Preparations of cereals, milk, and eggs for use as food.** GEOFFREY HUME ROTHERHAM, trading as Marvo Products, 14-20, Regent Street, London, S.W. 1. November 24. (By Consent.)

HEWETT.—580,365. **Wet fish, for food.** HEWETT AND COMPANY, LTD., 11 and 12, St. Mary-at-Hill, London, E.C. 3. December 1.

Advertised before acceptance, the applicants alleging distinctiveness.

HOTEX. — 581,040. **Ice-cream powders.** SIDNEY ARTHUR VICTOR BUTLER, 62 and 63, Minories, London, E.C. 3. December 1.

HYVO.—580,444. **Edible oils and edible fats.** COVO REFINING COMPANY, LTD., Unilever House, Blackfriars, London, E.C. 4. November 24. (By Consent.)

JAVELIN.—580,740. **Rice and rice flour.** WILLIAM GARDNER and ROLAND GARDNER, trading as Harvie and McGavin, 27, Washington Street, Glasgow, C. 3. December 8.

NET-GLYK.—579,424. **A substitute for glycerine prepared as an article of food.** NETTLEFIELD, LTD., 2, 4, and 6, Baches Street, Brunswick Place, City Road, London, N. 1. December 1.

OLD COUNTIES.—578,725. **Cheese and substances used for food containing cheese.** KRAFT CHEESE COMPANY, LTD., Silverdale Road, Hayes, Middlesex. December 8.

NEW COMPANIES

Arlington Hotel, Limited. (333291.) 4/11/37. 22, Half Moon Street, Piccadilly, W. 1. Proprs. of hotels, restaurants, etc. £100. Dir.: Cecile C. Barnard, 51/55, Cromwell Road, S.W. 5.

Walter Ashworth, Limited. (333141.) 29/10/37. Butchers, slaughtermen, etc. £5,000. Permt. dirs.: W. Ashworth, 8, Singleton Road, Heaton Moor, Stockport; W. S. Ashworth, 6, Alma Road, Heaton Moor, Stockport.

F. H. Bewley, Limited. (333234.) 2/11/37. 128, Tanners Hill, S.E. 8. Tobacconists, confectioners, and newsagents, etc. £100. Dirs.: F. H. Bewley, 128, Tanners Hill, S.E. 8; Mrs. W. D. Bewley, 128, Tanners Hill, S.E. 8.

Bon Mange, Limited. (333112.) 29/10/37. Fairmile Works, 35, Fairmile Road, Christchurch, Hants. Wholesalers or retailers of meat, fish, fruit, etc. £100. Dirs.: W. Hutchinson (ch.), Church Hatch, Church Street, Christchurch; F. C. Thomas, The Mount, Springfield, Chelmsford.

Bonus Fish Shops, Limited. (333113.) 29/10/37. 42, Darville Road, N. 16. Fishmongers, poulterers, etc. £500. Dir.: G. Bruskin, 42, Darville Road, N. 16.

Brighton (Blackpool), Limited. (333150.) 30/10/37. 465, Promenade, South Shore, Blackpool. Restaurateurs and hotel proprs. cd. on at the Brighton Hydro at Blackpool. £3,000. Dirs.: J. Lucas, 26, Birley Street, Blackpool; J. A. Spencer Collins, Baston Manor, Hayes, Kent.

Campbell's Hotels, Limited. (333152.) 30/10/37. Berkeley Lodge, 42, Poynders Road, Clapham Park, S.W. Hotel keepers, etc. £100. Dirs.: Jessie Harvey-Smith, 42, Poynders Road, Clapham Park, S.W. (permt. mang. dir.); Annie Craig, 42, Poynders Road, Clapham Park, S.W.

Caroni, Limited. (333296.) 4/11/37. To acquire the undertaking and assets of Caroni Sugar Estates (Trinidad), Ltd., and Waterloo Sugar Estates (Trinidad), Ltd. £100. Dirs.: Not named.

G. Cotton and Son, Limited. (333161.) 30/10/37. To take over the bus. of a pork pie mnfr. cd. on by G. Cotton at The Bakery, Nortoft Road, Bournemouth. £1,000 (200 "A" ord. and 800 "B" ord.). Dirs.: G. Cotton, 20, Gresham Road, Bournemouth; Mrs. G. F. Cotton, Gresham Road, Bournemouth.

Cream Cheese, Limited. (333298.) 4/11/37. Mnfrs. of cheeses, butter, and cream, etc. £10,000. Dirs.: To be appointed by the subs. Remun. of dirs.: As voted by the company.

F. G. Elford, Limited. (333192.) 1/11/37. 3/5, Southampton Street, Strand, W.C. 2. Fish and oyster mchts., etc. £600. Dirs.: F. G. Elford, 256, Leigham Court Road, Streatham, S.W. 16; H. Stephens, 22, Banstead Road South, Sutton, Surrey.

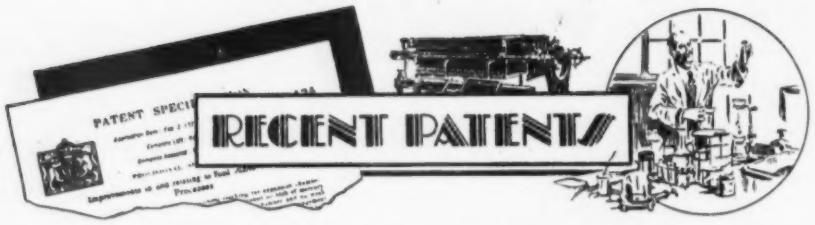
Erith Meat Products, Limited. (333233.) 2/11/37. Family butchers, etc. £3,000. Dirs.: R. Groom, Clevedon, Belmont Road, Erith, Kent; A. C. Green, 7, Perry Street, Crayford, Kent.

Betty Hamilton, Limited. (333111.) 29/10/37. Pastrycooks, bakers, confectioners, etc. £1,015 in 1,000 pref. shares of £1 and 1,200 ord. of 3d. Dirs.: R. Hogg, 23, Rowsley Avenue, Hendon, N.W. 4; T. J. Hamilton Brown, 3, Buckingham Street, W.C. 2; J. L. Vann, 13/14, Little Britain, E.C. 1.

Harveys Restaurant, Limited. (333122.) 29/10/37. 57, Poland Street, Oxford Street, W. 1. To carry on the bus. of restaurateurs, etc. £500. Dirs.: G. J. Harvey, 6, Birch Tree Road, Petts Wood, Kent; Bertha A. Harvey, 6, Birch Tree Road, Petts Wood, Kent.

F. W. James, Limited. (333235.) 2/11/37. White Horse Hotel, 1/3, Parson's Green, Fulham, S.W. 6. To take over the bus. of a licensed victualler cd. on at "The White Horse" Public House, 1 and 3, Parson's Green, S.W. £10,000. Dirs.: C. S. James, 20, Ilchester Place, Kensington, W. 14; C. W. S. James, The Traveller's Friend, Bath Road, Hounslow; J. D. James, The Chequers, Colnbrook Bye-Pass Road, Colnbrook, Bucks.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.



These particulars of New Patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The "Official Journal of Patents" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

25086. COHN, M.: Preparation of dough, etc. (Germany, September 16, 1936.)
27525. CORMACK, W. B.: Extraction of fermented beverages from casks, etc.
26682. CREAMERY PACKAGE MANUFACTURING CO., LTD.: Liquid-circulating means for pasteurising apparatus.
28317. FAIRBROTHER, H. (MEIER): Machines for shaping butter rolls, etc. October 18.
27304. FARRER, J. O. (CONTINENTAL CAN CO., INC.): Apparatus for coating shaped articles with liquid-coating material.
26444. GEORGE, W. P.: Milk coolers.
24598. GERSTLE, H.: Production of starch for food purposes. (Germany, September 16, 1936.)
29413. GOOLNIK, S.: Cartons for sweetmeats, etc.
26807. HAMON, K. F. M.: Manufacture of concentrated food. October 4.
25910. HARPER, T.: Sealing discs for milk bottles.
26792. HAY, A. W. HAJDUSKA: Manufacture of beverages. October 4.
26288. HEVES, T.: Package for powders, etc.
29086. HEYERDAHL, E. F.: Continuous extraction of oil, etc., from whales, etc. (Norway, October 26, 1936.)
26745. HOARE, A.: Automatic beer preservers.
25892, 25897. HUMPHRIS, F.: Moulds for compressing powdered, etc., articles.
26265. HUTTON, J.: Potato graders, etc.
26546. INTERNATIONAL BUSINESS MACHINES CORPORATION: Protein products.
27156. JONES, J. H.: Milk and malt beverages. October 7.
26214. LAERDAL, A.: Nutritive salts.
24576. LAING, J.: Food-preserving cans.
25976. LASSEN, W. O.: Fish-dressing machines. (Germany, October 23, 1936.) (Cognate with 25977, 25978.)
26247. LIGHTFOOT REFRIGERATION CO., LTD.: Apparatus for freezing inserts for ice-cream containers.
27314. MARSTON, C. C.: Machines for separating and cleaning grain, etc.
29238. NIELSON, A.: Egg-stamping devices.
25775. NUTBROWN, LTD., T. M.: Dough, etc., cutting appliances; pancakes.
27117. OELWERKE AKT.-GES., W. R. N.: Preparation of extracts from the flesh of whales, etc. (Germany, November 6, 1936.)

Complete Specifications Accepted

472,979. DUMBLETON, C., and BAKER PERKINS, LTD.: Biscuit and like ovens. (April 2, 1936.)
473,064. THORNLEY, B. D.: Production of anti-anæmic preparations. (March 5, 1936.)
473,269. TRIGGS, W. W. (SILKEBORG MASKIN-FABRIK, ZEUTHEN, AND LARSEN): Method of kneading butter in churns. (February 5, 1936.) (Convention date not granted.)
473,291. GENOVA, A. F.: Process and apparatus for the instantaneous preparation of ice-creams or freezing of other comestibles on potable liquids. (April 8, 1936.)
473,318. BURGESS, A. F. (LONG CO., W. E.): Method for preserving a perishable food product and a wrapping material for use in such method. (November 16, 1936.)
473,366. CONTINENTAL CAN CO., INC.: Apparatus for coating iron cans or like containers. (December 31, 1935.)
473,375. BULMER AND CO., LTD., B. P., DURHAM, H. E., and THOMAS, V. BEACH: Taps for casks or other vessels containing liquid. (July 14, 1936.)
473,394. HASS, V.: Process and apparatus for the heat treatment of milk. (December 24, 1935.)
473,451. ALLAN, E.: Curd-stirring machine.
473,476. COOPER, C. E. T., and MURTON, S.: Apparatus for grading fruit, eggs or other articles adapted to be handled separately. (June 11, 1937.)
473,550. DEUTSCHE HYDRIERWERKE AKT.-GES.: Manufacture of stable, water-containing, pasty, creamy or liquid emulsions. (April 13, 1935.)

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

468,810. GROUP I. **Food fats.** LUNDSGAARD, H. C.
In making edible emulsions of the water-in-oil type such as margarine, carbon dioxide or substances releasing it are incorporated prior to, during or after, or both during and after, the emulsification, together with one or more emulsifying agents which cause a stabilisation and a fine and uniform distribution of the carbon dioxide. The carbon dioxide may be introduced in the gaseous state, if desired under pressure, or in solid form. As substances releasing carbon dioxide, carbonates or bicarbonates with the equivalent amount of acid are preferably used. The carbon dioxide is present in the emulsions in dissolved and in chemically bound state and also as finely distributed bubbles. The emulsifying agents used are preferably pectin or monoglycerides or other water-in-oil emulsifying agents. In an example, margarine is produced by mixing 10 parts by weight of ripened milk with 6 parts of water and saturating with carbon dioxide by blowing the gas through at 0° to 5° C. Eighty-three parts of the oils used and 1 per cent. of an emulsifying agent such as a monoglyceride of a fatty acid are added to a closed mixer filled with carbon dioxide gas and mixed therein. The milk and oils are then fed separately in the desired proportions to the emulsifier and then to a chilled roll. Pectin may be added to the milk to the amount of 0·2 per cent. of the weight thereof, and carbon dioxide may also be supplied during the emulsification. The mixing and kneading of the emulsion is carried out in an atmosphere of carbon dioxide. In another example, a compound for use in baking is prepared by saturating 30 parts by weight of water containing 0·5 per cent. of pectin with gaseous carbon dioxide at 0° to 5° C. and then emulsifying in an oil-fat mixture containing 2 per cent. by weight of monoglycerides, further carbon dioxide being added during the emulsification to charge the emulsion with finely distributed carbon dioxide gas.

471,620. GROUP XVIII. **Delivering measured quantities of brine or other liquid.** HIRSCHMANN, O.
Apparatus for preserving meat by injection of brine or other preservative liquid consists of a container and a measuring vessel for the liquid, which are in direct communication by a pipe, the flow of the liquid into the vessel being effected and regulated by supply of compressed air through a pipe and a reducing valve to the container. A pipe supplies compressed air from container to the vessel to expel the liquid therefrom through a cock to which the injection needle is connected, the pipe having a three-way valve which also enables the vessel to be connected to atmosphere while it is being filled from a container through a pipe. Two containers and their measuring vessels are supported on a frame with a common supply of compressed air from a vessel to each container through a control valve. A device for measuring the supply of liquid from the vessel, which is made of glass or other transparent material, consists of a number of similar rods pivoted on a vertical shaft and provided at their ends with indentations, each half the depth of a rod. The shaft is carried by arms on a sleeve adjustably mounted and fixed by a screw on one of a pair of supporting columns between the base and cover of the vessel. The amount of brine used is determined by the weight of the piece of meat, the width of each rod corresponding, for example, to a half a kilogram and of each indentation to a quarter of a kilogram, as many rods as correspond with the weight of the meat being swung in against the vessel. Manometers indicate the pressure in vessel and container.